

hind, that walking (provided it was not too far) would contribute to the Expulsion thereof. The Bed having been made as requisite in those Occasions, and well warmed before she is put to it, where she must be placed in a Situation, proper to take her Repose, which is so indispensably necessary to repair her exhausted Strength, and recruit her Spirits; which Situation ought to be such as to have her Head and Body a little rising, as well to facilitate her Respiration, as to procure the Evacuation of the Blood which flows then, and which being intercepted, would cause violent Pains to the poor Patient; as it often does here in *England*, where a poor Woman being left, sometimes three Quarters of an Hour, or an Hour, in the miserable Condition she has been delivered, with all her Cloaths wet about her, great Clods of Blood are formed in the Matrice by the Introduction of the cold Air into it, which cause those Pains, they call After-Pains; and which the ignorant Midwife makes her believe to be the necessary Consequences of a Delivery. It is true, that it is impossible the Woman should be quite free from Pains, at that Time, since whatever Care may be taken, either in the Delivery, or immediately after, there is always some Air introduced in the Matrice, whereby some of the Blood, which is to be evacuated, is clodded, which Clods making some Violence, lesser or greater, according to their Bigness or Smallness, to the Matrice, then very sensible and tender, cause those After-Pains: But it is equally true, that if greater Care was taken of a Woman in her Delivery, and immediately afterwards, those Pains would be neither so violent, so frequent, nor so long.

The most common Custom here in *England*, is to give to the Woman soon after she is in Bed, a Spoonful of *Sperma Ceti*. In *France*, they give her an Ounce of Oil of sweet Almonds, extracted without Fire, and as much of Syrup of Maiden Hairs mixed together; which serves to soften inwardly the Throat, which has been heated, and is hoarse, by the great Efforts she has made to retain her Breath during her Labour; as likewise, that the Stomach and Intestines being anointed with it, may not be griped so much; this last Remedy is far more agreeable than the *Sperma Ceti*, and has the same Efficacy, if not more. Others give her only some good Broth, which they think better than any Draught. Then the Patient is left to take some Rest.

Note, That with Regard to the Bandage, which is convenient to a Woman after she is delivered, it must be very loose the first Day, when the Labour has been very hard; because if the Belly was kept too tight, it would hurt the Woman, which has it very painful at that Time, and likewise the Matrice which has been much fatigued; therefore that Bandage should be no tighter than to keep up the Belly, during the whole Time of the Evacuation of the Lochia. Though some keep it very tight, under Pretence of restoring the Belly to its former fine Shape, by diminishing, by Means of that tight Bandage, the Bigness thereof; but they are grossly mistaken, for in pretending to restore the Shape of the Woman, they, on the contrary, push by that Compression, the Matrice downwards, which is often the Cause, that the Woman remains a long while afterwards, incommoded by a great Weight in the Matrice, and that her Belly, instead of diminishing, is rather render'd bigger, because of the Fluxion which that painful Weight produces in that, and all the neighbouring Parts.

If the Woman is not to suckle her Child, there must be Remedies applied on her Breasts to dissipate the Milk; but if she designs to do it, her Breasts should be only kept close, and cover'd with soft and warm Cloths, for fear the Milk should grow knotted; and if it flows into it with too much Impetuosity, Embrocations are to be made on them, with Oil and a little Vinegar mixed together, dipping in it some Cloths to apply on them; observing, if the Woman will suckle her Child, that she should not give him the Breast but three, or even five Days after she is deliver'd, *i. e.* till the Humours, which have been in a great Ferment, and flow in great Abundance to the Breasts, in the first Days, be much abated.

As to the Regimen a lying in Woman is to observe, when no Accidents happen. — She must be treated in the first Days, with Regard to her Diet, as if she had a Fever; therefore she should be fed, particularly during the three or four first Days, with Chicken-Broth, Jellies, and the like; and likewise some boiled and even roasted Chickens, provided it be in a moderate Quantity. — As for her Drink, she may be suffer'd, if she has no Fever, to drink some white Wine, mixed with warm Water, for she is not to drink any Thing cold.

Note, That all I have said relating to the Conduct to be observed, with lying-in Women, is only when their Lying-in is not attended with any Accidents; for when it is, that Conduct must be different according to the different Accidents, such as a great Flooding, a Fall of the Matrice, the Contusions and Lacerations thereof, After-Pains, Suppression of the Lochia, Inflammation of the Matrice, Scyrrhe of the Matrice, Cancer of the Matrice, violent Looseness, Inflammation of the Breasts, Knotting of the Milk, Swelling of the Legs and Thighs, Suffocation of the Matrice, &c.

The Flooding, or Loss of Blood, which happens sometimes to a Woman immediately, or soon after she has been deliver'd, is caused by the Separation of the After-Birth from the Matrice, the Orifices of whose Vessels, are become three or four Times bigger during Gestation, than they were before; the Blood flowing then in greater Abundance, that it is more subtle, and naturally heated, either by the Fatigues of a tedious and long Labour; or by the Woman being of a sanguine Complexion, and has the Vessels of the Matrice bigger.

This Accident can often proceed from that the After-Birth has been separated from the Matrice, with too much Haste or Violence; or because some Portion thereof, or a false Conception is left in the Matrice; for that Part endeavouring then to expel it, squeezes and makes the Blood flow out of the Vessels newly open; and sometimes from a large Clod of that Blood remaining in the Substance of the Matrice.

The Loss of Blood is an Accident more dangerous than all the others which can happen to a Woman newly deliver'd, and sometimes causes her Death, before one has Time to remedy it: Therefore proper Remedies must be administer'd to the Patient, as soon as possible, examining what can be the Cause of such a Flooding; for if it be a false Conception, or a Portion of the After-Birth, or some Clods of Blood left behind in the Matrice, they must be immediately extracted, or the Expulsion thereof procured by some specifick Remedy; such as a few Drops of the Oil of *Gujacum* in *Plantain* Water. But if the Blood flows immoderately, though there be nothing left behind in the Matrice, the Woman must be let Blood in the Arm, if her Strength will permit it, observing while she bleeds to close by Intervals the Orifice of the Vein, the better to make Diversion of the Blood, without exhausting her Strength; she should lay her Body equally situated, without being rais'd; to hinder the Blood from flowing too much towards the inferior Parts; remaining still, without moving on one Side or the other. Her Belly must not be kept tight at all, especially if she feels Pains in it; neither is she to be much cover'd in her Bed; and Care should be taken, that the Air of her Chamber be a little cooled; though I know no better, nor quicker Remedy on that Occasion, than my Styptick; for a large Spoonful of it, stops the most immoderate Flooding, a few Minutes after it has been taken, without having Recourse to any others; which, on that Occasion, fatigues always very much the poor Patient, and very often accelerates her Death, instead of saving her Life, by exhausting entirely the little Strength she has left. But this, instead of exhausting it, cheers her up, at the same Time it stops her Flooding.

In Places where this Remedy is not to be had, if notwithstanding bleeding in the Arm, and other Remedies, the Flooding continues to Excess, the Woman must be laid on fresh Straw, with a single Sheet over the Straw, without any Matrass, that she may not have her Reins so much heated, putting along her Loins, Napkins dipped in cold Oxycrat; unless it was in Winter, in which case it must be warmed a little; giving her the Juice of *Pre-*

celine alone, or mixed with her Broth. Warming, likewise, the Region of the Heart with hot Cloths, and aromatized with *Hungary Water*, or some other proper Liquor. She must take every half Hour, a few Spoonfuls of good Broth, or one or two of good old red Wine.

But if, notwithstanding all these Remedies, the Blood continues always to flow (which never happens if she takes the Styptick above-mention'd) the Woman falls often into Syncope, and is in great Danger of her Life; because no proper Remedies can be applied on those Places where the Vessels are open; or if the Woman recovers after an excessive Loss of Blood, she has a few Days afterwards, a violent Pain in her Head, proceeding from the Fermentation of the new Blood; with a Fever, which is sometimes continual, and sometimes intermitting.

Note, That several Women having the first Evacuation of their Menfes, after their Lying-in, much more abundant than usual, some of them take that Evacuation for a Loss of Blood; though they be only their Menfes, much more abundant, because the Vessels of the Matrice, which have been much dilated, during Gestation, being not yet very well strengthen'd and contracted, let the Blood flow thus abundantly. This Evacuation, let it be ever so abundant, is never dangerous, when it proceeds from the Cause abovemention'd; and the only Remedies requir'd in that Case, are Repose, and Abstinence from Coition, till the Evacuation be entirely ceased.

As to the *bearing down and Fall of the Matrice*, and of the *Amus*; and of the *Hemorrhoides* in a lying-in Woman. To understand well the *bearing down of the Matrice*, we must distinguish two Kinds thereof.

The first Kind of *bearing down*, or *Relaxation*, is where the Body of the Matrice falls into the *Vagina*, in such a Manner, that introducing the Finger into it, the inward Orifice is felt very near. The second Sort, is when the Matrice being still lower, that inward Orifice is manifestly seen to appear on the Outside at the *Pudendum*.

The *Fall of the Matrice*, is also of two Sorts. — In the first, the Matrice falls quite out, though notwithstanding the Bottom thereof be not entirely fallen, or seen inwards, but only its Orifice, which appears at the Extremity of a big fleshy Mass, which composes the Body of the Matrice. And the other Sort of Fall of the Matrice, which is the most troublesome of all, is where the Matrice is entirely turn'd upside down, so that it appears without Orifice at all. The Matrice thus fallen, seems to be nothing else but a big Piece of bloody Flesh, much like a *Scrotum*, which hangs between the Legs of the Woman.

The *bearing down*, and *Fall of the Matrice*, proceeds either from the Relaxation, or Rupture of its Ligaments. Women who have a great Quantity of the Whites, are very subject to those Relaxations. The Ligaments are also much stretched, and relaxed, by tedious, and hard Labours; as likewise by a too frequent Gestation of large and heavy Children; sometimes by a violent Cough; by frequent and strong Sneezings; by Jumping, Falling, Rolling, or any other violent Shakes; for having lifted up heavy Burdens, for having strain'd too hard in going to Stool, &c. For all those Things shake and push the Matrice downwards, with much Violence, when there is a Child in it; and the Ligaments thereof, being thereby relaxed, or broken, cannot keep it up; which is the Cause that it descends, and falls easily, when the Child is out.

Note, That though it is said, that the Ligaments of the Matrice are broken by the Causes above specified, we must not imagine that there happens a total Rupture thereof, which would be very difficult to remedy, but there happens only a Separation of its Fibres, which stretch themselves afterwards more than they should.

But the most frequent Cause of the *bearings down*, and *Falls of the Matrice*, is that which proceeds from violent and tedious Labours; which happens principally when the Child presents himself in a Situation, in which he cannot come out, and when he has the Head too big; or when the inward Orifice is not enough dilated for his Passage, at the Time; for then the Matrice is pushed

with so much Force downwards, though the Child cannot advance forwards, that its Ligaments are extremely relaxed: Which is also occasioned by the strong Glysters indiscreetly administred to the Woman in Labour, to procure the Expulsion of a dead Child; as likewise when there is a Disposition towards it, the Midwife pulls hard, and all on a sudden the After-birth, which is much adherent to the Bottom of the Matrice; and much sooner still, if introducing the Hand into it she lays hold on, and draws instead of the After-birth the Body of the Matrice.

A Woman who has a Fall of the Matrice, feels a great Weight at the Bottom of her Belly, with a Difficulty of making Water, and an extreme Pain in the Reins and Loins, towards the Place where its Ligaments are fastned, and yellowish and bloody Humidities are seen to flow through that fleshy Mass which hangs between her Thighs.

If one remedies quickly to the Relaxation and Fall of the Matrice, by reducing it into its proper Place, that Malady is easily cured; and much sooner if the Woman be young, and the Distemper of a fresh Date; but if the Woman be old, and the Distemper of a long standing, it is incurable.

The Fall of the Matrice, which happens immediately after the Delivery, can cause the Death of the Woman in a few Hours, if it be not immediately reduced into its proper Place.

Note, That the *Fall of the Matrice*, causing the Woman's Death after she has been delivered, for Want of that Part having been reduced into its proper Place, must be attributed to the Ignorance of the Midwives, who mistaking that great Piece of bloody Flesh they see coming out at the Pudendum, for some Mole which Nature wants to expel, make very violent Efforts to draw it out with their Hands; which causes insupportable Pains to the poor Patient, and but too often her Death, for Want of having sent, in a convenient Time, for some Person very well skilled in the Art of *Midwifery*; for it happens then a great Flooding, and the Matrice thus fallen, is seen so much tumified, that it is impossible to reduce it afterwards; whence an immediate Death ensues.

For the Cure of this dangerous Malady, a Man-midwife must have Regard to two Things:—The first is to reduce the Matrice in its proper Place:—And the second to keep it up and strengthen it.

To reduce the Matrice, if it be entirely fallen, the Operator must, previously to any Thing else, procure the Evacuation of the Urine, and likewise that of the coarser Excrements by means of a gentle Glyster, that the Reduction thereof may be performed with more Facility. Afterwards, the Woman must be placed on her Back, with her Thighs a little higher than her Head: Then all that comes out at the Pudendum, must be fomented with warm Wine or Milk; and afterwards it must be pushed back gently with a soft Cloth, and if the Thing be very painful, by reason that what is already come out is very big and tumified, it must be anointed with Oil of Sweet Almonds, to make it slide easier; observing, after the Reduction is made, to wipe off that Oil as clean as possible, to prevent a Recidive. But if, notwithstanding all these Endeavours, the Reduction of the Matrice is unpracticable, because it is excessively inflamed and tumified, then there is a great Danger of a Gangrene, and consequently of the Life of the Woman; though *Ætius* and *Paul Aeginette* say, that some Women have escaped, to whom for such an Accident, the Matrice has been entirely extirpated. *Paré* relates some Histories of that Kind, as well as *Roussel* in his *Cesarian Delivery*; but those Examples are very rare.

The second Manner of curing that Malady (which consists in keeping up the Matrice in its proper Place, and in strengthening it, after it has been reduced) is to place the Woman on her Back, her Buttocks a little risen, a little cross legg'd, and the Thighs joined together, to hinder it from falling back again.

The best Means to keep the Matrice in its natural Situation, is to place a *Pessary* in the Vagina; observing

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notwithstanding that the bearing down of the Matrice, where the inward Orifice does not come out at the Labia of the Pudendum so as to be seen, wants no Pessary. Therefore they are not to be used in those Sorts of pretended Bearings down or Relaxations of the Matrice, which proceed only from that the Matrice being drenched and swelled with Humours, the Evacuation thereof is suppressed, causes that a Weight is felt in it; wherefore in those Dispositions the Globe of the Matrice being much more tumified than usual, its inward Orifice is felt very near the outward; and in those Circumstances, a Pessary, far from being useful, would only prove very painful to the Woman, by pressing hard on the Matrice.

When the Matrice evacuates its Lochia, the best Remedy to strengthen it, is to keep it in its natural Situation, by means of a Pessary; for the astringent Remedies which would be proper to hinder its Relaxation, would cause a great Prejudice to the Woman, by a Suppression of those Superfluities: Abstaining in those Cases from keeping her Belly tight, in which most Midwives are mistaken, who, thinking to keep the Matrice in its natural Situation, keep the Belly very tight with a Bandage, for in pressing it thus, they force the Matrice still more downwards. The Patient must make use at that Time of a Bed-Pan, that she may go to Stool while she lays, during which she'll have always her Hand before her Matrice to keep it from falling. But when the Time of her Purgations is entirely over, and there has been a sufficient Evacuation thereof, astringent Injections may be used without any Danger. Regard must be had likewise to the whole Constitution of the Body, to dry off all its Humidities by an universal Regimen; and the lying-in Woman must not get up, but after five or six Weeks, observing likewise to abstain from Coition during that whole Time; that the Matrice and its Ligaments may be strengthened in their natural Situation.

It happens also, sometimes, that by the violent Efforts the Woman makes during her Labour, the Anus is entirely pushed out; in that Case, if the Child be very far advanced in the Passage, the Midwife shall content herself, before that Accident happens, to hinder it, if she can, by desiring the Woman not to make such violent Efforts; but if it be entirely fallen, she shall wait till the Child be entirely out of the Matrice, to reduce it to its natural Situation; for it would be very difficult to do it before, without causing a great Contusion to the Intestine. Therefore as soon as the Woman is delivered, the Reduction thereof must be made in the same Manner of that of the Matrice, by fomenting, stewing, and anointing the Part, if it be necessary.

As to the *Hemorrhoides* or *Piles*, wherewith lying-in Women are troubled, they must be anointed Morning and Evening with an Unguentum made of Populeum, and Oyster-shells calcined; which I know to be a specific Remedy in that Case.

As to the *Contusions* and *Lacerations of the external Parts of the Matrice caused by the Delivery*.—Almost all Women complain in their first Labour, when their Child is at the Passage, that the Midwife pricks and scratches them in those Parts; and believe that the Contusions which are seen in those Parts after the Delivery, proceed from that they have been too roughly handled. But they are grossly mistaken, since that proceeds from that the Head of the Child makes in its Passage thro', a violent Distension and Separation of the four Caruncles, and other neighbouring Parts, which are sometimes lacerated; and hence the Pains, they say they feel then as if they were pricked or scratched, of which they never complain so much in the Labours following, because those Parts having given once Passage to the Child, are relaxed and extended afterwards much more easier.

Those Contusions and Lacerations ought not to be neglected, for Fear they should turn into malignant Ulceries; for the Heat and Humidity of those Places, besides the Lochia which flow continually from them, would contribute to those Ulceries, if the Application of proper Remedies was neglected.

Therefore as soon as the Woman is delivered, if there be but simple Contusions and Scratches, there must be applied on the lower Parts to appease the Pains, a small Cataplasim made with new-laid Eggs, the Yolk

and White mixed with Oil of Sweet Almonds, done on hot Embers, or very slow Fire, and stirred till the whole be pretty well mixed together; then having been spread on very soft Tow or Linnen, it must be applied over all the Outside of the Vulva, and remain there during five or six Hours; after which it must be taken off to apply on each Labia, small Pieces of Cloth dipped in Oil of St. Johnwort, renewing them four or five Times a-day, and washing those Parts with Barley-Water and Honey, to cleanse them of the Excrements which flow from the Matrice; and when the Woman shall want to make Water, they must be covered with a Piece of Cloth, to hinder the Urine from hurting them. But if those Lacerations be very painful, the Balsam of Peru is, in my Opinion, preferable to any other Remedy.

The Contusion of those Parts is sometimes so great, that they cause an Inflammation of the great Labia, where a pretty considerable Abscess is formed, occasioned by the Midwife handling those Parts in a very rough Manner. In that Case the Evacuation of the Matter formed in it, must be procured towards the most commodious Place, and which has the greatest Declivity. That Evacuation must be immediately followed by a detensive Injection, made into the Cavity which contained it, with the Water of a Forge, and Honey, quickened with a little Spirit of Wine, if there was any Danger of Corruption; treating besides the Ulcery, as the Art requires it.

But it happens sometimes by a still more deplorable Accident, that all the inferior Part of the Sleet is lacerated, by the Child coming out, as far as the Anus, whereby both Holes are made into one. To rectify this great Disorder, which otherwise would be very troublesome to the Woman, and loathsome to the Husband, the Re-union of the Parts thus lacerated must be made immediately after the Delivery, by washing first with strong Red Wine, made warm, all the Place lacerated, and making to it afterwards a pretty strong Suture, of one, or two, or more separated Stitches, according to the Length of the Separation, and taking at every Stitch a pretty deal of Flesh, to hinder it from parting. This done, the Wound must be dressed with the Balsam of Peru, or that of Arceus, covering the whole with a Cloth, to prevent the Urine from reaching to the Part. And that those Parts may re-unite with more Facility, the Woman must keep always her Thighs joined together, till the Cure be perfected.

If after this Re-union the Woman happens to be with Child, she'll be obliged, to avoid the like Accident, to anoint her Parts often with Oil, and emollient Pomatums; and when in Labour, ought not to make violent Efforts at first, suffering Nature to operate by degrees, and the Help of an experienced Man-midwife, who being informed of the first Disgrace, will endeavour to avoid a second; for commonly those Parts having been lacerated once, it is very difficult to prevent it in the Labour next following; because the Cicatrice renders the Places narrower still; therefore it would be much better if Women in that Condition could be persuaded to abstain from having any more Children, to avoid being exposed to the same Accident.

Note, That those exterior Parts of the Vulva are much less subject to a Laceration, in Women who have the Labia of the Pudendum hanging, than in those who have them plump and fleshy; and that the more violent and sudden the Labour-Pains are, the more considerable are those Lacerations; for those Labias in moderate Pains dilating themselves by Degrees, are not so soon lacerated, as when they suffer all on a sudden a violent Effort.

Note, also, That it happens sometimes that the Neck of the Bladder, which has suffered a hard Compression during three or four Days by the Head of the Child remaining in the Passage, it being impossible during that whole Time, that the Urine retained in the Bladder should be freely evacuated, is inflamed and separates entirely by the Putrefaction which happens commonly at the lower Parts of the Woman, in a hard Labour; which Suppuration degenerates at last into a Fistula, which causes an involuntary Emission

of Urine, which proves very troublesome to the poor Patient afflicted therewith, and is even incurable, when the Fistula is large, and proceeds from an entire Loss of the Substance of the Neck of the Bladder which has thus suppured. But if the Fistula be but small, and there is but a small Portion of the Substance lost, it is sometimes cured after two or three Months of Uneasiness. This Accident happens oftener in the first Labour, because the Head of the Child makes then a greater Contusion on those Parts, which have not been yet dilated, than in the other following Labours, where they bear easier and without any Prejudice, the Distension they have already received, unless the Bigness of the last Child should exceed much that of the first; in which Case, the same Accident could very well happen for the same Subject.

As to the *After-Pains*, and *their different Causes*. — The *After-Pains* are most commonly caused either by Winds contained in the Intestines, wherewith they are easily filled, immediately after the Delivery; or by some foreign Body left in the Matrice, whether it be a false Conception, or a Portion of the After-Birth, and very often Clods of Blood; and then those Pains are very like the Labour-Pains, and are not appeased by Glysters, like those caused by Winds, but, on the contrary, are excited and increased till those foreign Bodies be entirely expelled, or extracted from the Matrice; or by a sudden Suppression of the *Lochia*, the Matter thereof filling up with Plenitude the whole Substance of the Matrice, makes a great Distension of it, and causes, by its sojourning in it, an Inflammation, which is communicated by Means of the Peritoneum to all the Parts of the lower Abdomen, wherefore it swells, and grows extremely hard; which Accident, when it continues, causes often the Death of the Woman in a very short Time; or lastly, by the violent Extension of the Ligaments of the Matrice, proceeding from a hard Labour. In that Case the Pains are more fix'd in the Reins, Loins, and Groin, than in any other Part, because the Ligaments of the Matrice are fasten'd to those Places; notwithstanding which, those Pains are often communicated, by a Continuity to the whole Matrice, and much sooner if it has suffer'd some Contusion in a hard Labour.

Note, That it is a vulgar Opinion, that a Woman is not so much troubled with After Pains in her first Labour, than in the following; which, notwithstanding, is entirely contrary to the Sentiment of *Hippocrates*, who says, *lib. 1.* of the *Maladies incident to Women*, that Women are much more troubled with After-Pains in their first Labour, than in those which follow; but a daily Experience shews us, that there is no infallible Rule for such a Thing; which happens according as the present different Dispositions of the Woman contribute more or less to it; since there are Women as much troubled with After-Pains, in their first lying in, as they are in the following; which depends on the greater or less Disposition the Blood has, in some Women than in others, to coagulate itself in the Matrice: That Disposition proceeding from two Causes, the first, according as the Blood is more or less in Motion, by the Agitation of the Labour; and the second, according as it is more or less fibrous. — But the first Labour of a Woman being most commonly more laborious than the others, her Blood has less Disposition towards coagulating itself immediately after the Delivery, either because it is then in a greater Motion, which is the Cause, that it flows liquid out of the Cavity of the Matrice, without sojourning in it, as soon as it is out of its Vessels, or because it is then more serous; for Women drinking much to appease the great Thirst caused by the Agitation of their Labour, the Fibres of their Blood are more divided by the Abundance of the Liquor, wherewith their Arteries and Veins are extraordinarily filled; which can contribute, in some Measure, towards hindering the Women from being so much troubled with After-Pains, in their first lying in, as they are in the following. A third Cause may be added to the two others, which is, that the inward Orifice of the Matrice, which had never been dilated, suffering a greater Violence in the first Delivery, by the coming out of the Child, and

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being thereby more debilitated, it cannot be so soon contracted as in the following, or suffering not so much Violence, it contracts itself much sooner after the Delivery; which done, it retains in the Matrice, the Blood which flows from the Vessels, which being thus stopped, forms in it great Clods, which supplying the Place of a strange Body, and increasing in Volume by the Addition of new Blood, which flows into it, make a painful Distension of that Part, in hindering it from contracting itself, as it endeavours to do after the Child is come out.

All Sorts of *After-Pains* are to be remedied, according to their different Causes. — Therefore to prevent the *After-Pains excited by Wind*, the Woman must take, soon after she is deliver'd, either half an Ounce of Oil of sweet Almonds, and an equal Quantity of Syrup of Maiden Hairs, mixed together, or some *Sperma ceti*, or fifty Drops of Oil of Anniseed, with some Syrup of Marsh-mallows; or some good Broths.

Note, That Women of Quality in *France*, take most commonly, after they are deliver'd, some Broth, made of an old Partridge, boiled together, pretending that such Broth has a particular Virtue to appease the *After-Pains*; others prefer boiled Milk, in which are mixed two or three Walnuts, pounded with some Sugar; straining the whole Mixture, very hot, through a Cloth; though this Remedy would be consider'd, in *England*, as a Kind of Poison.

If the *After-Pains* proceed from a foreign Body being left in the Matrice, the Expulsion thereof must be procured, or it must be extracted by introducing the Fingers into its Entrance, as I have said, in speaking of the Extraction of a false Conception; or if it be great Clods of Blood, which being likewise stopped in the Matrice, cause those Pains, they infallibly cease, so soon as they are expelled or extracted; but the same Accident begins again, soon after, if new Blood flows into the Bottom of the Matrice, and if it be coagulated a-new, as it happens pretty often; for it can suffer nothing in its Capacity after the Delivery.

Those Clods of Blood are also formed and stopped in the Cavity of the Matrice, because its inward Orifice which contracts itself soon after the Woman is deliver'd, hinders the Blood from being evacuated as soon as it is out of the Vessels.

When a Woman has a sudden Suppression of her *Lochia*, which flowed at first in Abundance, that Suppression causes always *After-Pains*; and the most salutary Remedy is to procure the Evacuation thereof; which is done by hot Glysters, and aperitive Pomentations on the genital Parts, and by bleeding in the Foot.

As to the Pains which the Woman may feel in the *Loins and Groins*, proceeding from the too great Distension, or Rupture in that Part of the Ligaments fastened towards those Places, Repose alone, and a good Situation of the Body, will suffice to strengthen and consolidate them, without any other Remedy; because other Remedies cannot be conveyed actually to the Place where they are situated; observing, notwithstanding, a good Regimen; without forgetting, in those different Causes, of the *After-Pains*, to govern well the natural Evacuation of the *Lochia*.

As to the Suppression of the *Lochia*, and the Accidents it causes. The Causes of the Suppression of the *Lochia*, proceed either from a violent Leoteness, because there happens then a too great Evacuation of the Humours, which stops that of the *Lochia*; or from some strong Passions of the Soul, as Fear, Sorrow, Wrath, &c. because the Humours are thereby concentrated, and by their too quick and sudden Return, they cause sometimes a Suffocation: A great Cold stops, likewise, the *Lochia*; because it contracts the Vessels, and the Pores of the Matrice, and thereby hinders all the Humours which had flowed into the Matrice, by the Labour-Pains, from excluding with Ease: The Use of astringent Remedies produces, likewise, that Accident, as well as the strong and frequent Agitation of the Body.

To procure or facilitate the Evacuation of the *Lochia*, the Woman must be easy in her Mind; lie on her Back, with her Head and Breast a little rising, keeping herself

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very still, that the Humours may be the easier carried downwards by their natural Propensity; she must also observe a good Regimen, using rather boil'd than roasted Meat, for Fear of a Fever, abstaining from all Things which are astringent; and drinking by Intervals, some Glasse of Hysterick and Penny-Royal Waters, mixed together, and warm Glysters ought to be administer'd to them to draw the Humours downwards; bathing the lower Parts with an emollient and aperitive Decoction; made of Mallows, Parietary, Camomile, Melilot, Roots of Asparagus, and Linseeds; making, with the same Decoction, an Injection into the Matrice; making of the Herbs, after they have been well boiled, so as to be easily strained through a Sieve, a Cataplasme, to which must be added Oil of white Lillies, or Axonge of Pork, which shall be applied hot on the lower Abdomen, heating it from Time to Time, in the same Decoction: Besides which, strong Frictions shall be made on her Thighs and Legs, particularly towards the Inside; without forgetting bleeding in the Foot, or in the Arm, according as the Accidents caused by the Suppression of the Lochia require it. Though, in my Opinion, a few Drops of Oil of Cinnamon, in a Glasse of Hysterick and Penny-Royal Waters, several Times reiterated, if the Accidents require it, answer very well in those Cases all the Intentions of a Man-midwife.

The Suppression of the Lochia abovemention'd, causes very often, and particularly if it happen soon after the Delivery, an Inflammation of the Matrice, which is a very dangerous Malady, and kills most of the Women to which it happens. It proceeds also, sometimes, from a Contusion, or Wound in the Matrice, caused by a Blow or a Fall; and particularly when a Woman has been very ill used in a hard Labour, by an ignorant Midwife; or because some foreign Body, or a Portion of the After-Birth has been left in the Matrice, which is corrupted in it; or because the Belly of the Woman is kept too tight.

The Inflammation of the Matrice is known in that it is very painful, and much more tumified after the Delivery than it should; the Woman feeling a great Weight at the Bottom of her Belly, which swells, and becomes almost as big as it was before she was delivered: She has a Difficulty of making Water, and of going to stool; she feels likewise an Increase of Pains, while she voids her Excrements, because the Matrice presses then the Intestine *Rectum* on which it is situated, and by its Proximity, communicates to it, its Inflammation, as well as to the Bladder; having, besides, a violent Fever, and a great Difficulty of Respiration, attended with a Hickup, Vomiting, Convulsions, Delirium, and then Death, if the Malady be not soon remedied.

Note, That a Woman who has received some Contusion, or a violent Compression of the Matrice, is in great Danger after the Inflammation (if she don't die of it) of having an Abscess formed there, or a scyrrhus Tumour, and even, sometimes, an incurable Cancer, which will render the rest of her Days miserable and languishing.

The Inflammation must be remedied as soon as it is perceived, which is done in temperating the Heat of the Humours, and in evacuating their Abundance as soon as possible; making first the Extraction, or procuring the Expulsion of the foreign Bodies left in the Matrice after the Delivery, in the Manner heretofore mentioned; treating the Woman gently at that Time, without using any Violence, for fear of increasing the Distemper.

The Humours will be tempered by a good and cooling Regimen; the Woman contenting herself then, for her whole Food, with Broth made of Veal and Chickens, abstaining from Wine, in lieu whereof, she'll drink a Pilsane, made with the Roots of Chicory, of Strawberries, Barley, and Liquorice, using besides, of Emulsions made with the cold Seeds, and Barley-Water; keeping still in her Bed, and her Belly being kept loose, as well on the Outside, by its being free of all Bandages, and the Inside with Anodyne Glysters, made only of Bran boiled in River-Water, to which is added a Spoonful of Sweet Oil.

The Humours are evacuated by Bleeding, which

must be first in the Arm, and not in the Foot, reiterating it without Loss of Time, till the greatest Plenitude be evacuated, and the Inflammation of the Matrice a little abated; after which it may be done in the Foot. An Embrocation of Oil of sweet Almonds, mixed with a little Vinegar, should also be made on the Belly; and even some Injections into the Matrice, provided it be not with any Thing astringent, for fear that, by causing a still greater Suppression of the Lochia, which always flows a little on that Occasion, the Malady should grow worse. Therefore none but Remedies which temperate without any Astringent, should be used then, as Barley-Water, and warm Milk; abstaining likewise from using any Thing too cooling, and from all Sorts of Diureticks; but more particularly from Purgatives.

The *Inflammation of the Matrice* turns sometimes into an Imposthume, which produces a great Abundance of Matter; then there is a great Danger of Corruption in the Part, either by Reason of its Heat and Humidity, which are the Principles thereof, or because proper Remedies cannot be applied to it: Therefore as nothing else can be done, one must prescribe to the Woman a good Regimen, with some deterfivive Injections to cleanse the Part of the Matter, lest by sojourning too long in it, it should grow too abundant. But if the Imposthume turns into a cancerous Ulcer, as it often happens; then whatever Remedies may be administer'd to the Patient, that Malady will accompany her to the Grave; in which Case, palliative Remedies only are of some Service.

As to the Scyrrhe of the Matrice.—The Matrice being continually drenched with the Superfluity of the Humours which flow from all the Parts of the Body, it becomes often scyrrhus, because of the Obstruction of the Parts through which those Superfluities should be evacuated; which *Scyrrhe* is often a fatal Consequence of the Inflammation, which has not been well dissolved, and has not well suppured.

Sometimes none but the inward Orifice of the Matrice is scyrrhus; then the Orifice is not much bigger than usual; but at other Times its whole Body is scyrrhus, as well as its inward Orifice, and extremely tumified; as it happens often, after an Inflammation happening after a Delivery; or, at other Times, after a long Suppression of the Menfes.

The *Scyrrhe* of the Matrice is easily known in feeling it, either by laying the Hand on the Woman's Belly, or introducing a Finger into the Vagina; for the Body of the Matrice is felt much bigger than usual, and harder; its inward Orifice is likewise bigger, harder, more unequal and shorter, and without any considerable Pain, when the *Scyrrhe* does not participate of the Inflammation, and is not disposed to degenerate into a Cancer; for then the Part would be very painful.

A Woman who has a *scyrrhus Matrice*, feels a great Weariness in her whole Body, a great Weight at the Bottom of her Belly, Pains in the Reins, Groins, Thighs, frequent Motions to make Water, and the Pains increasing when she goes to stool, by Reason of the Compression of the Matrice on the Intestine *Rectum*, and on the Bladder; her Menfes are either entirely suppressed, or flow in a very small Quantity without any Rule, because of the Obstruction of the Part.

The Matrice being a Part appointed for the Evacuation of all the superfluous Humours of the Woman's Body, it is certain, that the *Scyrrhe* which happens to it, is a very dangerous Malady, often followed by several others, which are mortal; because those Superfluities being debarred of their usual Evacuation, flow back over the whole Body, and particularly towards the principal Parts which they vitiate; and corrupt afterwards. And those Humours being kept a long Time in the Substance of the Matrice, and fermenting there, acquire a malignant Quality, which is often the Cause, that the *Scyrrhe* degenerates into an incurable Cancer.

Aetius is of Opinion, that the *Scyrrhe* of the Matrice is easily cured, when only in its Orifice, or in the Vagina; and with Difficulty when in the Bottom of the Matrice; but that Malady is commonly so very rebellious to Remedies, that it cannot be truly said that the *Scyrrhe* of the Vagina is easily cured, but with Respect to that which is in the Body of the Matrice.

The Cure of the *Scyrrhe*, of what Nature soever it may

be, is to be attempted at first by bleeding in the Arm, and gentle Purgatives, using afterwards of emollient Remedies, as well those which can be applied on the Belly, viz. Oils, Axonges, Cataplasms, or Fomentations; as of those which can be introduced in the Matrice, in Injection, Vapour, &c. which should have no Acrimony; which done, the Woman may make use of the Half-bath, or Whole-bath for some Days before she is let Blood in the Feet, abstaining above all Things from Coition, and observing a good Regimen during the whole Time of the Cure: Whey and As's Milk are of great Service in that Malady.

The Scyrrhe of the Matrice is often succeeded by a Cancer in the same Part; which happens when the Humours the Substance of the Matrice is soaked with, come to be over-heated by a Fermentation thereof, because of their sojourning too long in that Part.

The Cancer is likewise occasioned by the Inflammation of the Matrice after a Delivery: It can also happen at other Times, and to all Sorts of Persons, whether young or old, and even to Maids, tho' very seldom.

The Ulcer of the Matrice, is absolutely incurable, either because it cannot be extirpated, as that of the Breasts, or because the Matrice receives continually the Superfluities of the whole Body of the Woman; whereby the Malignity of the Ulcer increases daily, notwithstanding all the Remedies which can be used during that cruel Malady, which never ends but by the Death of the Patient.

Therefore, since the Cancer of the Matrice is incurable when confirmed, one should neglect no Means to prevent it, when a Woman has some Disposition to it; to which are subject all Women who have their Matrice scyrrhus, or have had some Imposthumes in that Part; as likewise those who are subject to Losses of Blood, and those who have not regularly their Menfes, or are of an Age to lose them entirely; for Women are much more afflicted at that Time with that Malady, than at any other. The most sovereign Remedy a Woman of that Age can use to prevent a Cancer of the Matrice, is bleeding in the Arm, often reiterated; and to supply the Want of a menstrual Evacuation, and to hinder the Blood and Humours from flowing in a too great Abundance towards the Matrice, she must make use of the same Remedy from Time to Time, for several Years, till Nature has entirely lost the Habit it had contracted of sending the Blood towards the Matrice for the Evacuation of the Menfes, and the Vessels from which the Blood flowed be entirely contracted; and if the Woman be subject to frequent Losses of Blood, she must abstain entirely from Coition, it being extremely prejudicial to her, because the Matrice being much heated and agitated in the Action, the Loss of Blood is thereby very often excited. She'll make use of a cooling and humecting Regimen, avoiding all Things aperitive, and Diureticks, as likewise, all violent Purgatives: And to temperate as much as possible the Acrimony of the Humours, after having took some gentle Purgative, she must live for some Time on new Milk, using by Intervals some Chicken-Broth.

Note, That I knew a Woman here in London, who died about six Years ago of a Cancer in the Matrice, which a famous Surgeon told her could be cured if she could keep her Appetite, to recruit the Blood she voided through the natural Parts; which Advice engaged her to be always eating something, and all Things indifferently; though I told her that it was the only Means of accelerating her Death, which happened two or three Months afterwards.

The Looseness which happens sometimes to a Woman newly delivered, proceeds, in my Opinion, from her Stomach having been weakened by the violent Efforts she was obliged to make during her Labour; which is some Time before it can recover its former digestive Faculty, for the perfect Coction of the Aliments; and sometimes likewise from the Ripopées given by Midwives to a Woman in Labour, under Pretence of helping and accelerating her Delivery, particularly those poisonous Cordials, as they are pleased to call them, which serve only to blunt the Dissolvent of the Stomach.

Of what Nature soever the Looseness of a Woman

newly delivered may be, and from what Cause soever it may proceed, it is always of a bad Consequence, and often puts the Woman in great Danger of her Life, because it hinders the Evacuation of the Lochia of the Matrice; which being suppressed causes always very dangerous Accidents, and but too often Death itself. What's the most fatal in this Malady is, that all Remedies proper to stop a Looseness, increase always the Suppression of the Lochia; and those which can procure the Evacuation of the suppressed Lochia, increase the Looseness; therefore a Physician don't dare to prescribe any Astringent to be taken inward; neither is the Patient to be purged at the Beginning of her Lying-in. Notwithstanding which, one must endeavour as much as is possible at that Time, to administer some Remedies proper for that Malady, by giving the Patient some good Broth to restore her Strength, much impaired by the Looseness. Some Spoonfuls of Mutton Juice (extracted in Balneo Mariæ, or between two deep Dishes without Water, and without the least Fat) given by Intervals to the Patient, I know by Practice to be a Specifick in that Malady; giving her likewise, if the Looseness continues, some Drops of Laudanum. But if the Looseness be accompanied with a Fever and other Accidents, the Patient must be let Blood in the Arm to supply the Want of Purgatives; and if the Looseness puts her in greater Danger of her Life than would do the Suppression of the Lochia, all the Remedies used at other Times for that Malady, are to be administered then; and the Looseness being stopped, the Evacuation of the Lochia, which had been suppressed, is to be procured as well as one can.

As to the Tumours of the Belly, called *ventral hernies*. The Matrice grows so prodigious big during Gestation, that it fills the greatest Part of the lower Abdomen, which in its natural Situation, being incapable to contain it, is forced to extend itself, in Proportion as the Matrice increases, which is done sometimes in so extraordinary a Manner, and with such Violence, that the Peritoneum being incapable to dilate itself sufficiently, breaks; whence follows a Separation of the Muscles, and a Tumour in the same Place, into which the Intestine, or the Epiploon, and sometimes the Matrice itself with the Child falls.

That Rupture of the *Peritoneum* happens sometimes above, and sometimes underneath the Navel, between the two right Muscles; it happens likewise, very often at the Umbilick, or towards the Groins, because those Parts are the weakest of the Abdomen. It is most commonly caused by the violent Efforts of a hard Labour; or by those of a violent Vomiting, frequent Sneezing, or by some Blow which the Woman has received in her Belly, or by a Fall, or other Things capable to do her some sudden Violence; to which Women with Child contribute much, by lacing themselves too tight, to appear a fine Shape still; whereby their Belly having not the Liberty to extend itself equally on all Sides, suffers a greater Violence than it should, towards the inferior Part.

This Malady is not only very deform, but is besides attended with bad Consequences, for it causes Indigestions, Vomitings, Cholicks, and several other Accidents, which sometimes put the Woman in Danger of her Life; as it happens when the Intestine which is fallen through the Laceration of the Peritoneum, cannot be pushed back into the Abdomen, without making an Incision to the Part: The Matrice has even been seen forced out of the Abdomen, at the Beginning of a Pregnancy, by Tumours of that Nature, which could not be reduced; and therefore are the Cause of the Woman's Death; because by the Increase of the Child the Tumour grows so big, that it is impossible to reduce the Matrice into its natural Situation.

Note, That *Sennerte*, 1. part. lib. 2. c. 9. of the Maladies incident to Women, mentions a semblable Accident, which happened to the Wife of a Cooper at the Beginning of her Pregnancy, who helping her Husband to bend a Pole, received a violent Blow of that Pole towards the left Groin, which caused a Rupture of the Peritoneum, which was followed by a Tumour, which increased soon to such a Degree, that the Matrice

which

which was contained in that Tumour, could never be pushed back into the Abdomen, because of the Increase of the Child in it, whom she carried thus out of her Belly, as in a Sack, being only cover'd with the Matrice and the Skin; till the Time of her Labour happening, the Surgeon was obliged to extract her Child by the *Cesarian* Operation, by Reason of the Impossibility of reducing the Matrice into the Belly, in order for her Delivery in the ordinary Way. That Operation saved the Child's Life, but it proved destructive to the Mother, who died sometime afterwards.

Women can preserve themselves against those Ruptures of the Abdomen, if they avoid during Gestation, all that can cause them some sudden and violent Effort; leaving the Liberty to their Belly of extending itself equally on all Sides; therefore they are never to lace themselves too tight, while they are with Child; and if notwithstanding that Precaution, that Accident should happen through the violent Efforts of a hard Labour, the best Remedy they can use, is to wear a proper Bandage, garnished with Compresses well adjusted on the Tumour of the Belly, to push back the Parts which could fall into it; and if the Rupture was in a Place where the Matrice could be pushed entirely into it, as it happen'd to the Woman abovementioned, and the Woman perceives that she has conceived, she must use a very great Precaution to avoid that Accident, and likewise, to hinder the Rupture from growing bigger by the Pregnancy; as it almost always happens; therefore it would be very proper that she should keep her Bed, all the Time she is with Child.

As to the Inflammation of the Breasts of a lying-in Woman.—All the Blood and Humours are so heated and agitated during the Labour, that the Breasts, all composed of glandulous Bodies, receiving in too great Abundance those Humours which flow thither from all Parts, are easily inflamed, because that Repletion makes a very painful Distension thereof; to which the Suppression of the Lochia of the Matrice, and the universal Plenitude of the Body, contribute much.—That Inflammation proceeds also, sometimes, from that the Woman has pressed too much her Breasts within her Stays, or has received some Blow in those Parts, or has laid on them; or because she has abstained from giving the Breast to her Child, because the Milk which is in great Quantity in the Breasts, being not evacuated by suckling, is heated and corrupted by sojourning too long in them.

But whatever may be the Cause of the *Inflammation of the Breasts* of a lying-in Woman, proper Remedies must be applied to it, as soon as possible, lest they should break out, or for Want of Suppuration, remain in them a scyrrhus Hardness, which, in Process of Time, could degenerate into a Cancer; which is a very dangerous Malady, and almost always incurable, when confirmed.

Besides the Danger of the *Inflammation of the Breasts*, degenerating into those dangerous Maladies, it most commonly happens, that the Woman feels in those Parts an extream Pain, which causes her often an Ague, to which succeeds a Fever, with such a Heat of the whole Body, that she can scarce suffer any Covering upon her, and when she uncovers herself ever so little, even only to keep her Arms out of the Bed, she has another Ague, which increases afterwards the Heat of the Fever; which will not appear surprising, if one considers, that the Breasts being very near the Heart, they communicate easily their Inflammation to it; which even sometimes excites Delirium, and Frenzy, if the Blood be carried to them with too much Impetuosity, and gathered in them in too great Abundance.

The principal and surest Means to hinder the Humours from being carried in too great Abundance to the Breasts, is to procure a good and ample Evacuation of the Lochia, through the Matrice; for by that Evacuation, all the Humours will take their Course towards the lower Parts.

The Cure is began by bleeding in the Arm, to empty the too great Plenitude of the Vessels of the whole Body; proceeding to that in the Foot, for a greater Diversion of the Humours, and to make the Lochia flow

in greater Abundance; during which, topick Remedies are to be applied on the Breasts, viz. at the Beginning, Embrocations of Oil of sweet Almonds and Vinegar mixed together, applying afterwards Emplasters of the cooling Cerat of *Galian*, with one Third of Populeum; and if the Pain was very great, a Cataplasm must be made of Crumbs of Bread and Milk, adding to it Oil of sweet Almonds, and some Yolks of Eggs, putting over it Compresses dipped in *Oxyerat*, or Plantain Water; observing, however, that the Remedies applied on the Breasts be only cooling and refraining, without any great Astringent; otherwise they would cause a scyrrhus Tumour, which would continue a long Time, and perhaps degenerate at last into a worse Malady.

When the greatest Rage of the Inflammation is over, and most of the antecedent Humour is evacuated, one must use resolute Remedies, to digest, dissolve, and consume the Milk, which is in the Breast in too great Abundance; for fear it should be corrupted by sojourning in them. Therefore it must be evacuated, either by the Child, or some other Person sucking it, or be Resolution, otherwise it should be evacuated by Suppuration. Though it is best to dissolve it, than draw it in that Manner, when the Woman does design to suckle her Child; for suckling draws other Milk to the Part, which would cause the same Accident, if it was not evacuated in its Turn.—But if the Milk chances to flow of itself from the Breasts, it must not be stopped; because then an Evacuation thereof is made without Attraction.

The Dissolution of the Milk is made by applying on the Breasts a Cataplasm of Honey alone; or by rubbing red Cabbage Leaves with it, which must be applied on the Breasts, after they have been a little soften'd over the Fire, and have been separated from their large Ribs; taking great Care not to press the Breast too hard, and that the Cloths put upon it be very smooth, without any Pleats or Seams. A very good Remedy for the same Distemper, is to boil a red Cabbage whole in River Water, till it be very soft, and there be but very little Water left, after which it must be pounded a little in a Wooden or Marble Mortar, to strain it through a Sieve, like Pap, and make it afterwards into a Cataplasm, adding to it some Honey, and Oil of Camomile, which Cataplasm is to be put on the Breasts.

While the Woman is under Cure, she must observe a cooling Regimen, and very little nourishing, to hinder the Generation of too much Blood and Humours, of which there is already a too great Abundance. Her Body ought to be kept open, that the Humours, which otherwise would flow to the Breasts, may be carried downwards. During the whole Time the Inflammation will last, she must keep her Bed, and lay on her Back, that she may rest better; for if she was up the Breasts which are heavy, by Reason of the Humours they are filled with, would be very painful when they hung down; abstaining, as much as possible, from moving her Arms; because the principal Muscles appointed for that Motion, being situated under the Breasts, cannot act without agitating the Breasts, which are then very painful; and after the fifteenth Day of her Delivery, when she will have had a pretty ample Evacuation of the Lochia, and the Height of the Inflammation will be over, and the Fever quite gone, she must be purged once or twice, according as the Case requires it, to evacuate the rest of the bad Humours.

But if, notwithstanding all these Remedies, the Swelling of the Breasts be not abated, and they remain still very painful, the Patient feeling a great Pulsation in them, being harder in one Place than in another, one may be sure that an Imposthume is forming in them; of which hereafter.

As to the Knotting of the Milk.—In the first Days after a Woman has been deliver'd, her Milk is not yet well purified, because of the great Motion of her whole Body, during the violent and frequent Efforts of her Labour; and it is then mixed with a great Quantity of other Humours, which flowing at that Time, in too great Abundance towards the Breasts, cause the Inflammation above-mentioned; but when the Child has already sucked, during fifteen or twenty Days or more, then the Milk alone, without any Mixture of other Humours, is contained in them; but that Milk being sometimes re-

tained too long, without any Evacuation, curdles and knots, and by its being over-heated, renders the Breasts very painful.

Note, That several Authors make a Distinction between this Curdling of the Milk, and another Malady which they call *Casatio*, in which the Milk is converted into Cheese, which happens by means of the Heat, whereby a Dissolution of the most subtile Part of the Milk being made, the coarser Part thereof is indurated in the Glands of the Breasts.

The Signs that the Milk is curdled or knotted are, that the Breasts which before were soft and smooth, grow hard, uneven, and lumpy every where, without any Redness; whereby the Distinction and Separation of all their Glands, filled with that curdled Milk, is easily felt. They are very painful to the Patient, who feels a shivering in the Middle of her Back, as if she had a Piece of Ice there; which Shivering is commonly followed by a Fever, which lasts no longer than twenty-four Hours, and sometimes less Time, unless that knotting degenerates into a true Inflammation of the Breasts, which would certainly happen if the Milk was not evacuated, or dissipated, or resolved.

That *Curdling of the Milk*, proceeds very often from that the Woman is not enough drawn, either because she has a too great Abundance of Milk, or because her Child is so small, or so weak, that it cannot suck, or because it wants to leave off suckling; for then the Milk remaining in the Breasts after its Coction, without being evacuated, loses its Sweetness, and by means of the Heat it acquires there, by reason of its too long sojourning in them, growing sour, it curdles and knots. That Accident happens often likewise to the Woman, for having suffered a great Cold, and had her Breasts too much exposed to the Air; because the Milk being thereby too much chilled, curdles, as the Blood does when exposed to the Cold.

The quickest and surest Remedy in this Malady, let the Cause thereof be what it will, is that the Woman should have her Breasts sucked dry; but as her Child, if he be small or weak, cannot have Strength enough to do it, she must be drawn by another Woman till her Breasts be put in a Condition of being easily drawn afterwards, and in order that she may not generate more Milk than is sufficient for the Food of the Child, she must use light Aliments, and her Body be kept open. But as it happens sometimes that the Woman will not, or cannot suckle her Child, then other Means must be used for the Cure of this Malady, and not by sucking the Breasts; for by drawing other Humours into them, the Malady would always be renewed, therefore it is necessary to hinder the Milk from flowing thither any more, and to dissolve and dissipate that which remains in them; to effect which, the Plenitude of the Body must be evacuated by bleeding in the Arm, and the Humours drawn downwards by pretty strong Glysters, and even by bleeding in the Foot, using likewise Purgatives if it be necessary; and to dissolve, digest, and dissipate the Milk knotted in the Breasts, an Embrocation of Populeum is used with Success; applying afterwards on the Breasts a Cataplasim of Honey, or a Plaister of *Dia-chylon de Gummis*.

As to the *Imposthumes of the Breasts of lying-in Women*. As those *Imposthumes* follow most commonly the Inflammation caused by the Corruption of the Milk, and by the too great Abundance of Blood and Humours carried thither; when a Man-midwife has done all he can to appease that Inflammation, either by the universal Evacuations of the Body, or by bleeding in the Arm and in the Foot, or by exciting the Evacuation of the Lochia, by repelling Remedies, and simple Resolutives applied on the Breasts; if the Woman continues to feel in them a violent Pain, and a strong Pulsation more in one Place than in another, together with a Hardness of a livid Colour, it is a Sign that there will be an Abscess; then one must abstain from applying any longer those former Topicks, to have Recourse to Remedies maturative of the *Imposthume*, which in that Case, it is best to bring to a Suppuration, rather than to use any longer Repellings and Resolutives, for Fear of hardning the Matter in repelling or dissolving the most subtile Part

thereof, and leaving the coarser behind, which would cause a scyrrhous Tumour very difficult to be dissipated; or which remaining a long while, as it happens sometimes, would degenerate into a *Cancer*.

To help the Suppuration of the *Imposthumes*, there must be applied on the Breasts an emollient and maturative Cataplasim, composed of Mallows, Marsh-mallows, Roots of white Lillies, and Linseed bruised, which must be boiled together till they be extremely soft, so as to be strained through a coarse Sieve, for Fear any Thing hard should remain in it, which could bruise the Breasts at that Time very painful; mixing with it afterwards a good Quantity of Axonge of Pork, or of *Basilicum*; and on the Place where the *Imposthume* seems to be ready to break, there must be applied a small Plaister of the said *Basilicum*, and the Cataplasim over it, renewing it twelve Hours afterwards, continuing the same Remedy till the *Imposthume* be ripe.

As soon as the *Imposthume* is ripe it must be opened, if it does not break of itself; and the Time of opening it will be known, when the Pulsation which the Woman felt before in her Breasts has ceased, when the Pains and Fever are much abated, and when the Middle of the *Imposthume* is a little risen in Point, is entirely soft, and the Inundation of the Matter contained in it is felt with the Finger.

Therefore when all those Signs appear, the *Imposthume* must be opened in the most proper Place for the Evacuation of the Matter. The Aperture must be made with a Lancet, and large enough for the Evacuation of the small Clods of Blood ordinarily mixed with the Matter, taking a particular Care not to touch the large Vessels, the Principal whereof are under the Arms. After the Matter has been evacuated, the *Imposthume* ought to be deterged and mundified as usual, observing only not to introduce too long and too hard Tents into it, but only some very soft Lint, which must not be pushed too far in. If there be a violent Pain, the Pledgets must be dipped in Oil of Eggs, or in *Basilicum* mixed with the Digestive, if something be left in it to suppurate; after which Mundicatives and Deterfives are to be used, as Honey, or the *Apostolorum*, applying over it a Plaister of *Unguentum Divinum*, to soften and dissipate the Hardness which could be left behind.

Sometimes all the Glands of the Breasts happen to suppurate, and to form as many *Imposthumes* as there are Glands; so that they break sometimes in five or six Places, which all flow with Sania; the Surgeon then ought not to amuse himself to make so many Apertures as there are small Holes, but it suffices to make a good one, or two in the Places which have more Declivity; for the whole Matter which has an easy Communication from one Place to the other, by the Breasts being all spongy, will be easily evacuated, and one or two good Issues made in a commodious Place, will drain in a short Time all the others.

But the surest Means to cure the *Imposthumes* of the Breasts after the Evacuation of the Matter, and to hinder the Apertures from being too long fistulous, is to dissipate entirely the Milk from both Breasts, whereby the Ulcers will be sooner and easier dried; wherefore the Body of the Woman must be kept open; and she is to be purged by Intervals, to evacuate the superfluous Humours and carry them downwards, she observing all the while a very little nourishing Regimen.

Note, That the Matter of the Abscesses must not be suffered to sojourn too long in the Breasts after its Maturity, as several Women do, who chuse that the *Imposthume* should break of itself, rather than suffer that it should be opened with a Lancet, which is the Cause that the Matter being kept too long in the Breast corrupts the proper Substance of its Gland, whereby communicating itself to the Reservoirs of the Milk, it renders the Cure very tedious, because the Evacuation of the Milk and of the Serosities which have took their Course through the Apertures of the Abscess, hinders the Consolidation of the Part; and particularly who, notwithstanding they have an *Imposthume* in one Breast, suckle their Child with the sound one, because of the mutual Communication of the

which was contained in that Tumour, could never be pushed back into the Abdomen, because of the Increase of the Child in it, whom she carried thus out of her Belly, as in a Sack, being only cover'd with the Matrice and the Skin; till the Time of her Labour happening, the Surgeon was obliged to extract her Child by the *Cesarian* Operation, by Reason of the Impossibility of reducing the Matrice into the Belly, in order for her Delivery in the ordinary Way. That Operation saved the Child's Life, but it proved destructive to the Mother, who died sometime afterwards.

Women can preserve themselves against those Ruptures of the Abdomen, if they avoid during Gestation, all that can cause them some sudden and violent Effort; leaving the Liberty to their Belly of extending itself equally on all Sides; therefore they are never to lace themselves too tight, while they are with Child; and if notwithstanding that Precaution, that Accident should happen through the violent Efforts of a hard Labour, the best Remedy they can use, is to wear a proper Bandage, garnished with Compresses well adjusted on the Tumour of the Belly, to push back the Parts which could fall into it; and if the Rupture was in a Place where the Matrice could be pushed entirely into it, as it happen'd to the Woman abovementioned, and the Woman perceives that she has conceived, she must use a very great Precaution to avoid that Accident, and likewise, to hinder the Rupture from growing bigger by the Pregnancy; as it almost always happens; therefore it would be very proper that she should keep her Bed, all the Time she is with Child.

As to the Inflammation of the Breasts of a lying-in Woman.—All the Blood and Humours are so heated and agitated during the Labour, that the Breasts, all composed of glandulous Bodies, receiving in too great Abundance those Humours which flow thither from all Parts, are easily inflamed, because that Repletion makes a very painful Distension thereof; to which the Suppression of the Lochia of the Matrice, and the universal Plenitude of the Body, contribute much.—That Inflammation proceeds also, sometimes, from that the Woman has pressed too much her Breasts within her Stays, or has received some Blow in those Parts, or has laid on them; or because she has abstained from giving the Breast to her Child, because the Milk which is in great Quantity in the Breasts, being not evacuated by suckling, is heated and corrupted by sojourning too long in them.

But whatever may be the Cause of the *Inflammation of the Breasts* of a lying-in Woman, proper Remedies must be applied to it, as soon as possible, lest they should break out, or for Want of Suppuration, remain in them a scyrrhus Hardness, which, in Process of Time, could degenerate into a Cancer; which is a very dangerous Malady, and almost always incurable, when confirmed.

Besides the Danger of the *Inflammation of the Breasts*, degenerating into those dangerous Maladies, it most commonly happens, that the Woman feels in those Parts an extream Pain, which causes her often an Ague, to which succeeds a Fever, with such a Heat of the whole Body, that she can scarce suffer any Covering upon her, and when she uncovers herself ever so little, even only to keep her Arms out of the Bed, she has another Ague, which increases afterwards the Heat of the Fever; which will not appear surprising, if one considers, that the Breasts being very near the Heart, they communicate easily their Inflammation to it; which even sometimes excites Delirium, and Frenzy, if the Blood be carried to them with too much Impetuosity, and gathered in them in too great Abundance.

The principal and surest Means to hinder the Humours from being carried in too great Abundance to the Breasts, is to procure a good and ample Evacuation of the Lochia, through the Matrice; for by that Evacuation, all the Humours will take their Course towards the lower Parts.

The Cure is began by bleeding in the Arm, to empty the too great Plenitude of the Vessels of the whole Body; proceeding to that in the Foot, for a greater Diversion of the Humours, and to make the Lochia flow

in greater Abundance; during which, topick Remedies are to be applied on the Breasts, viz. at the Beginning, Embrocations of Oil of sweet Almonds and Vinegar mixed together, applying afterwards Emplasters of the cooling Cerat of *Galian*, with one Third of Populeum; and if the Pain was very great, a Cataplasme must be made of Crumbs of Bread and Milk, adding to it Oil of sweet Almonds, and some Yolks of Eggs, putting over it Compresses dipped in *Oxyerat*, or Plantain Water; observing, however, that the Remedies applied on the Breasts be only cooling and refraining, without any great Astringent; otherwise they would cause a scyrrhus Tumour, which would continue a long Time, and perhaps degenerate at last into a worse Malady.

When the greatest Rage of the Inflammation is over, and most of the antecedent Humour is evacuated, one must use resolute Remedies, to digest, dissolve, and consume the Milk, which is in the Breast in too great Abundance; for fear it should be corrupted by sojourning in them. Therefore it must be evacuated, either by the Child, or some other Person sucking it, or be Resolution, otherwise it should be evacuated by Suppuration. Though it is best to dissolve it, than draw it in that Manner, when the Woman does design to suckle her Child; for suckling draws other Milk to the Part, which would cause the same Accident, if it was not evacuated in its Turn.—But if the Milk chances to flow of itself from the Breasts, it must not be stopped; because then an Evacuation thereof is made without Attraction.

The Dissolution of the Milk is made by applying on the Breasts a Cataplasme of Honey alone; or by rubbing red Cabbage Leaves with it, which must be applied on the Breasts, after they have been a little soften'd over the Fire, and have been separated from their large Ribs; taking great Care not to press the Breast too hard, and that the Cloths put upon it be very smooth, without any Pleats or Seams. A very good Remedy for the same Distemper, is to boil a red Cabbage whole in River Water, till it be very soft, and there be but very little Water left, after which it must be pounded a little in a Wooden or Marble Mortar, to strain it through a Sieve, like Pap, and make it afterwards into a Cataplasme, adding to it some Honey, and Oil of Camomile, which Cataplasme is to be put on the Breasts.

While the Woman is under Cure, she must observe a cooling Regimen, and very little nourishing, to hinder the Generation of too much Blood and Humours, of which there is already a too great Abundance. Her Body ought to be kept open, that the Humours, which otherwise would flow to the Breasts, may be carried downwards. During the whole Time the Inflammation will last, she must keep her Bed, and lay on her Back, that she may rest better; for if she was up the Breasts which are heavy, by Reason of the Humours they are filled with, would be very painful when they hung down; abstaining, as much as possible, from moving her Arms; because the principal Muscles appointed for that Motion, being situated under the Breasts, cannot act without agitating the Breasts, which are then very painful; and after the fifteenth Day of her Delivery, when she will have had a pretty ample Evacuation of the Lochia, and the Height of the Inflammation will be over, and the Fever quite gone, she must be purged once or twice, according as the Case requires it, to evacuate the rest of the bad Humours.

But if, notwithstanding all these Remedies, the Swelling of the Breasts be not abated, and they remain still very painful, the Patient feeling a great Pulsation in them, being harder in one Place than in another, one may be sure that an Imposthume is forming in them; of which hereafter.

As to the Knotting of the Milk.—In the first Days after a Woman has been deliver'd, her Milk is not yet well purified, because of the great Motion of her whole Body, during the violent and frequent Efforts of her Labour; and it is then mixed with a great Quantity of other Humours, which flowing at that Time, in too great Abundance towards the Breasts, cause the Inflammation above-mentioned; but when the Child has already sucked, during fifteen or twenty Days or more, then the Milk alone, without any Mixture of other Humours, is contained in them; but that Milk being sometimes re-

tained too long, without any Evacuation, curdles and knots, and by its being over-heated, renders the Breasts very painful.

Note, That several Authors make a Distinction between this Curdling of the Milk, and another Malady which they call *Caseatio*, in which the Milk is converted into Cheese, which happens by means of the Heat, whereby a Dissolution of the most subtile Part of the Milk being made, the coarser Part thereof is indurated in the Glands of the Breasts.

The Signs that the Milk is curdled or knotted are, that the Breasts which before were soft and smooth, grow hard, uneven, and lumpy every where, without any Redness; whereby the Distinction and Separation of all their Glands, filled with that curdled Milk, is easily felt. They are very painful to the Patient, who feels a shivering in the Middle of her Back, as if she had a Piece of Ice there; which Shivering is commonly followed by a Fever, which lasts no longer than twenty-four Hours, and sometimes less Time, unless that knotting degenerates into a true Inflammation of the Breasts, which would certainly happen if the Milk was not evacuated, or dissipated, or resolved.

That Curdling of the Milk, proceeds very often from that the Woman is not enough drawn, either because she has a too great Abundance of Milk, or because her Child is so small, or so weak, that it cannot suck, or because it wants to leave off suckling; for then the Milk remaining in the Breasts after its Coction, without being evacuated, loses its Sweetness, and by means of the Heat it acquires there, by reason of its too long sojourning in them, growing sour, it curdles and knots. That Accident happens often likewise to the Woman, for having suffered a great Cold, and had her Breasts too much exposed to the Air; because the Milk being thereby too much chilled, curdles, as the Blood does when exposed to the Cold.

The quickest and surest Remedy in this Malady, let the Cause thereof be what it will, is that the Woman should have her Breasts sucked dry; but as her Child, if he be small or weak, cannot have Strength enough to do it, she must be drawn by another Woman till her Breasts be put in a Condition of being easily drawn afterwards, and in order that she may not generate more Milk than is sufficient for the Food of the Child, she must use light Aliments, and her Body be kept open. But as it happens sometimes that the Woman will not, or cannot suckle her Child, then other Means must be used for the Cure of this Malady, and not by sucking the Breasts; for by drawing other Humours into them, the Malady would always be renewed, therefore it is necessary to hinder the Milk from flowing thither any more, and to dissolve and dissipate that which remains in them; to effect which, the Plenitude of the Body must be evacuated by bleeding in the Arm, and the Humours drawn downwards by pretty strong Glysters, and even by bleeding in the Foot, using likewise Purgatives if it be necessary; and to dissolve, digest, and dissipate the Milk knotted in the Breasts, an Embrocation of Populeum is used with Success; applying afterwards on the Breasts a Cataplasim of Honey, or a Plaister of *Dia-chylon de Gummis*.

As to the *Imposthumes of the Breasts of lying-in Women*. As those *Imposthumes* follow most commonly the Inflammation caused by the Corruption of the Milk, and by the too great Abundance of Blood and Humours carried thither; when a Man-midwife has done all he can to appease that Inflammation, either by the universal Evacuations of the Body, or by bleeding in the Arm and in the Foot, or by exciting the Evacuation of the Lochia, by repelling Remedies, and simple Resolatives applied on the Breasts; if the Woman continues to feel in them a violent Pain, and a strong Pulsation more in one Place than in another, together with a Hardness of a livid Colour, it is a Sign that there will be an Abscess; then one must abstain from applying any longer those former Topicks, to have Recourse to Remedies maturative of the *Imposthume*, which in that Case, it is best to bring to a Suppuration, rather than to use any longer Repellings and Resolatives, for Fear of hardning the Matter in repelling or dissolving the most subtile Part

thereof, and leaving the coarser behind, which would cause a scyrrhous Tumour very difficult to be dissipated; or which remaining a long while, as it happens sometimes, would degenerate into a *Cancer*.

To help the Suppuration of the *Imposthumes*, there must be applied on the Breasts an emollient and maturative Cataplasim, composed of Mallows, Marsh-mallows, Roots of white Lillies, and Linseed bruised, which must be boiled together till they be extremely soft, so as to be strained through a coarse Sieve, for Fear any Thing hard should remain in it, which could bruise the Breasts at that Time very painful; mixing with it afterwards a good Quantity of Axonge of Pork, or of *Basilicum*; and on the Place where the *Imposthume* seems to be ready to break, there must be applied a small Plaister of the said *Basilicum*, and the Cataplasim over it, renewing it twelve Hours afterwards, continuing the same Remedy till the *Imposthume* be ripe.

As soon as the *Imposthume* is ripe it must be opened, if it does not break of itself; and the Time of opening it will be known, when the Pulsation which the Woman felt before in her Breasts has ceased, when the Pains and Fever are much abated, and when the Middle of the *Imposthume* is a little risen in Point, is entirely soft, and the Inundation of the Matter contained in it is felt with the Finger.

Therefore when all those Signs appear, the *Imposthume* must be opened in the most proper Place for the Evacuation of the Matter. The Aperture must be made with a Lancet, and large enough for the Evacuation of the small Clods of Blood ordinarily mixed with the Matter, taking a particular Care not to touch the large Vessels, the Principal whereof are under the Arms. After the Matter has been evacuated, the *Imposthume* ought to be deterged and mundified as usual, observing only not to introduce too long and too hard Tents into it, but only some very soft Lint, which must not be pushed too far in. If there be a violent Pain, the Pledgets must be dipped in Oil of Eggs, or in *Basilicum* mixed with the Digestive, if something be left in it to suppurate; after which Mundicatives and Deterfives are to be used, as Honey, or the *Apostolorum*, applying over it a Plaister of *Unguentum Divinum*, to soften and dissipate the Hardness which could be left behind.

Sometimes all the Glands of the Breasts happen to suppurate, and to form as many *Imposthumes* as there are Glands; so that they break sometimes in five or six Places, which all flow with Sania; the Surgeon then ought not to amuse himself to make so many Apertures as there are small Holes, but it suffices to make a good one, or two in the Places which have more Declivity; for the whole Matter which has an easy Communication from one Place to the other, by the Breasts being all spongy, will be easily evacuated, and one or two good Issues made in a commodious Place, will drain in a short Time all the others.

But the surest Means to cure the *Imposthumes* of the Breasts after the Evacuation of the Matter, and to hinder the Apertures from being too long fistulous, is to dissipate entirely the Milk from both Breasts, whereby the Ulcers will be sooner and easier dried; wherefore the Body of the Woman must be kept open; and she is to be purged by Intervals, to evacuate the superfluous Humours and carry them downwards, she observing all the while a very little nourishing Regimen.

Note, That the Matter of the Abscesses must not be suffered to sojourn too long in the Breasts after its Maturity, as several Women do, who chuse that the *Imposthume* should break of itself, rather than suffer that it should be opened with a Lancet, which is the Cause that the Matter being kept too long in the Breast corrupts the proper Substance of its Gland, whereby communicating itself to the Reservoirs of the Milk, it renders the Cure very tedious, because the Evacuation of the Milk and of the Serosities which have took their Course through the Apertures of the Abscess, hinders the Consolidation of the Part; and particularly who, notwithstanding they have an *Imposthume* in one Breast, suckle their Child with the sound one, because of the mutual Communication of

the Vessels of both Breasts; therefore the Matter must be evacuated as soon as it is arrived to a perfect Maturity; and while it is not yet contained in the Teguments; for in proceeding thus the Abscess is sooner cured; and much sooner still, if the Woman abstain from suckling her Child, and her Body be kept open.

As to sore Nipples.— Sometimes Nurses, especially for the first Time, are subject to have sore Nipples, which are Parts of an exquisite Sense; because several small nervous Threads come to terminate in them; which causes them an excessive Pain, especially when, notwithstanding that Indisposition, they will suckle their Child. And much more if their Breasts are hard to be drawn; as it often happens, when they lay in of their first Child; at which Time the Milk has not yet forced its Way through the Breasts; which is the Cause that the Child pulls much harder, than when the Milk flows as it were of itself; and sometimes the Soreness increases to that Excess, by the continual sucking of the Child, that he carries at last the Nipple quite off; after which the Woman can suckle him no longer, and it remains an Ulcery, which is sometimes very difficult to be cured. Often, likewise, that Accident proceeds from that the Child is so drouthy and famished, that he does not take Time to suck gently, and finding that the Milk does not come so soon as he could wish, he bites, and chaws so hard the Nipples, thinking thereby to make it come, whether he has Teeth or not, that he scratches them, and thus continuing always carries them quite off. It happens sometimes, likewise, that Children have their Mouth so over-heated, or so full of those little Ulceries, called *Aphtes*, that therefrom the Nipples are ulcerated; and much easier if they have the Venereal Disease, which they communicate to their Nurses; and then the Ulceries proceeding from such a poisonous Source, are not cured by the common Remedies; but, on the contrary, increase always more and more.

So soon as a Woman perceives that she begins to have sore Nipples, it would be very proper she should abstain from suckling her Child, till they be quite cured; during which the Milk must be dissipated for some Time, for Fear of an Inflammation in her Breast, proceeding from a too great Abundance of Milk; notwithstanding which, if there was but one Nipple sore, she could very well give the other to her Child.

There must be applied on the sore Nipples, some Oil of Eggs, or Oil of new Wax, for several Days successively; using afterwards of desiccative Remedies, as Aluminous, and Lime-Water; bathing them first with Plantain-Water only, and applying over it Bits of very soft Cloth, dipped in the Aluminous, and Lime-Water; but, in my Opinion, the best Remedy is either Cream, or Honey of Roses, especially when the Nipples are not yet excessively sore.

Note, That some use Emollients instead of Desiccatives; but it must be observed, that Emollients are only proper to prevent a Soreness of the Nipples; but when that Soreness has happened, the Emollients are no longer of any Service, in lieu thereof, Desiccatives ought to be used.

To hinder the Woman from being hurted in those Parts which are so tender, and the Cloaths from adhering to them, the Ends of the Breasts must be cover'd with a little Hat made of Wax, Wood, or Lead, perforated with several Holes, as well for the Issue of the Sania, which flows from the little Ulceries, as for the Evacuation of the Milk which distills continually from the Nipple.

When the Child has carried the Nipple quite off, the Milk must be entirely dissipated, in order to dry, as soon as possible, the Ulceries left behind, which otherwise could not be cured so easily, but, on the contrary, would become callous and malignant in Time; and while the Child suckles, it is very difficult to cure the Ulceries, which he has caused to the Breasts, by his having the Venereal Disease; therefore he must have another Nurse, to which preservative Remedies ought to be administer'd. But if he had only small Ulceries in his Mouth, without any Malignity, his Mouth must be washed with Barley Water, mixed with a little Quantity of Lemon Juice;

tho' I prefer to it a Decoction of Marsh-mallows. And to temperate the Heat of the Humours, the Nurse must observe a cooling Regimen, and be bled, if it be judged proper.

When the Nipples are carried off quite, it is very difficult for the Woman to suckle her Child, because he has no Hold to suck the Milk; and likewise, because the small Holes of the Breast are obliterated by the Ulceries. If notwithstanding these Difficulties, she desires to do it, another Woman must make her, by Degrees, other Nipples, after the Ulceries are cured; or use a Glass Instrument, made for the Purpose, by Means whereof, she'll be able to suck herself five or six Times a Day, and thereby form new Nipples; and to form and keep up the new Nipple, she must cover it with the little Hat abovementioned.

The *Swelling of the Legs and Thighs of a lying-in Woman*, proceeds often, from a Reflux happening over all her Parts of the Humours, which should be evacuated together with the Lochia, wherewith the large Nerve of the Thigh is sometimes so much drenched, that a Woman runs the Risk of remaining lame afterwards.

If those Swellings be extremely large and painful, as are those which participate of Inflammation, and precede the Evacuation of the Lochia, and are accompanied with a Fever, with a Difficulty of Respiration, and an excessive Tension, and great Pains in the Abdomen, they are the much more dangerous, than those Accidents are great, and they meet several or all together. But when the Swellings are moderate, and without a Fever, they are often easily dissipated by Urine, and Purgatives: For those Sorts of Swellings most commonly happen, by Reason of some Obstruction towards the Region of the Reins; which is the Cause that the Excretion of Urine being but small, the superfluous Humidities of the Bodies which are not well purged, flow back on the lower Parts, whereby they are thus tumified.

To remedy to that Accident, there must be procured an ample and free Evacuation of the Lochia, as well as of the Urine, by administering to the Woman, fifteen Grains of Salt of Urine, in Conserve of Hips; and by Intervals, a Glass of an aperitive Pilsane made with Fennel, Parsley Roots, and Betony; mixing in each Glass thereof, half an Ounce of Syrup of Marsh-mallows.

As to the hysteric Passion, vulgarly called, *Suffocation of the Matrice*. This Malady is commonly accompanied with a great Number of different Accidents, according to the different Disposition of the Persons afflicted therewith; and causes so many Changes, and so many Alterations in the Functions of the Body, and of the Soul of a Woman, that it may be very well compared to the Faculty, *Proteus* had of changing himself into all Sorts of different Forms; for we see that among Women afflicted with that Indisposition, some have their Pulse high, others low and small; in some it is so weak, that it is scarce to be felt; others are pale, and remain cold and immoveable during the whole Paroxysm of the Malady, as if they were dead; and others have a fresh Colour, agitating themselves extraordinarily; some have at that Time convulsive Motions, others breathe almost imperceptibly, and without any manifest Motion of the Muscles of Respiration; and others with the greatest Difficulty: Some remain without Knowledge, till after the Paroxysm, when they remember nothing of what they have said and done during the whole Time; and others preserve all the while, their Memory, Reason, and Judgment: Some are more merry than usual, laughing and singing all the Time; and others are sorrowful and cry; some suffer in the Paroxysms of that Malady several other Symptoms, which do not appear alike in all Sorts of Women, but some in one rather than in others, according to the different Disposition of those afflicted therewith. This Distemper usually takes by Paroxysms, which return sometimes oftentimes, and sometimes seldom; which Paroxysms last, sometimes, several Hours, and often whole Days; and other Times are dissipated, and pass quickly; according as the Causes last more or less Time.

The Cause of all those Accidents can very justly be attributed to the Matrice, when that Part suffers some Intemperies, either because of the Suppression of the Menstrues, or by the Abundance of the Whites, or because of some other Humour or corrupted Matter, proceeding

from an Ulcery in that Part, or of some foreign Body, retained in its Cavity, as likewise of some false Conception corrupted in it; whereby the Nerves distributed to the Matrice, being irritated, excite the others which have Communication with them, to cause in the Parts where they are inserted, an irregular Motion, which produces Accidents according to the Irregularity of that Motion.

But, notwithstanding, the Cause of all the Accidents, observed in the hysteric Passion, is not always to be attributed to the bad Disposition of the Matrice, and of the Parts depending thereon, no more than to the Retention and Corruption of the Menfes, and of the Seed; because often a corrupted Humour happening to ferment in the Foldings of the Mesentery, or in the *Pancreas*, or in the Melt, or in the Kidneys, can cause almost all the same Accidents, by the same Communication of the Nerves of the sixth Conjugation, distributed in all those Parts, without the Matrice being in the least indisposed; in Confirmation whereof, several Widows, who, though they never use Coition, as they used to do before their Viduity, and Nuns, who live in Chastity, are subject to those Indispositions, as well as old Women, who have neither Menfes nor superfluous Seed.

This Malady is most commonly more frightful than dangerous, though some Women, after they have been troubled, during those Paroxysms, with very violent convulsive Motions, have fallen into a mortal Apoplexy, and others have remained Paralyticks, afterwards, of half of their Body, for several Years.

Two Things are chiefly observed in the Cure of the hysteric Passion; one is to hinder the Woman before the Paroxysm happens, from being afflicted therewith; and the other to remedy, even in the Time of the Paroxysm, to the Accidents which accompany it.

To answer the first Intention, if the Menfes, or Lochia of the lying-in Woman be suppressed, they must be provoked by Fomentations of all the neighbouring Parts of the Matrice, Half-baths, Bleeding in the Foot, Glysters, Purgatives, and other proper Remedies; and if that Malady was caused by a false Conception, or a Portion of the After-Birth left in the Matrice, they must be either expelled, or extracted from it as soon as possible.

No better Remedy can be administer'd to a lying-in Woman, during the Paroxysms of the hysteric Passion, than a Glas of Hysteric, or Cinnamon Water, or if such a Thing is not be found, a Spoonful or two of Brandy, or a Glas of Wine; I have also prescribed with great Success, twelve Drops of Spirit of Sal-Armoniack, more or less, according to the Violence of the Paroxysm.

Note, That having thus far carefully examined all the Maladies a lying-in Woman is subject to; discovered the principal Causes thereof, their Diagnosticks and Prognosticks, and inform'd my Pupil how to treat each Malady in particular, I'll conclude this useful Treatise, by teaching him how to behave towards a Child newly born; and how to cure the different Maladies he is subject to; therefore,

As to the Manner of treating a Child newly born; and first, how to tie and cut the Umbilick.—So soon as the Child is out of the Matrice, some Midwives tie and cut the Navel-string (which is the common Practice of the *English* Midwives) before they deliver the Woman of her After-Birth; which is a very bad Practice, for they should always, if possible, defer cutting the Navel-string, till after they have extracted the After-Birth; for the Matrice, which is extremely open, after the Child is come out, is in Danger of being too much cooled, while the Midwife amuses herself to make the Ligature of the Umbilick; besides that, its inward Orifice beginning to contract itself so soon as the Child is out, renders the Delivery of the After-Birth much more difficult.

Therefore, so soon as the Woman is delivered of the After-Birth, the Midwife having put at the Entrance of the Matrice a Cloth folded into several Doubles to hinder the Air from penetrating into it, shall take a strong Thread in four or five Doubles, of the Length of a Quarter of a Yard or thereabout, tied with a single Knot, at each End; with this Thread she shall tie the

Navel-String, at a Finger's Breadth from the Belly, with a double Knot, at first, then turning the two Ends of the Thread on the opposite Side, she'll make there another double Knot, reiterating the same Thing, if it be necessary, for a greater Safety; which done, the Navel-String must be cut at another Finger Breadth from the Ligature, on the Side of the After-Birth, so that there remains of the Navel-String only the Length of two Fingers Breadth, in the Middle whereof the Ligature is made; which must be so tight, that not one single Drop of Blood may run from the Vessels, but not too much, for fear the Ligature should cut the said Vessels; therefore the Thread should be a little big for that Purpose, and tied with some Sort of Mediocrity, tho' it is best it should be rather tight than loose; for some Children have unfortunately lost their Lives with their Blood, before it could be perceived, by having their Umbilicks tied too loose.—The End of that Umbilick, thus tied and cut, must be wrapped in a dry Piece of Cloth, anointed with some fresh Butter, or Oil of Roses; then having put another small Piece of Cloth, in double, on the Belly of the Child, towards the superior Part thereof; the Umbilick, thus wrapped, must be placed upon it, the End thereof upwards, that, in case the Vessels were not tied tight enough, the Blood should not so soon be lost, and unperceived, as it would if that End was placed downwards; for it happens, sometimes, that the Navel-String is so big, in some Children, that though it has been tied ever so tight, at first, the Ligature, notwithstanding, happens to slack, when it begins to wither and dry, whereby the Blood would flow, if it was not well minded. In that Case, therefore, in Proportion as the Umbilick withers, it must be tied with a new Knot.

The Umbilick thus tied withers daily, and most commonly falls out at the End of six or seven Days, sometimes sooner, and never later than the eighth or ninth Day. It must always fall of itself, without exciting it to it, for fear that was it to fall too soon, and before the Vessels are entirely closed and re-united, there should happen a Flux of Blood, which would prove very dangerous; or an Ulcer should be left, very difficult to cure.

Note, That I must not pass, in this Place, a Thing of the utmost Consequence unobserved, and which is sometimes capable to kill a new-born Child, without any Body knowing the Cause thereof; though it is the pernicious Custom some Midwives have, who, before they make the Ligature of the Navel-String, thrust into the Belly of the Child all the Blood contained in the Vessels thereof, under Pretence of strengthening the Child if he be weak; but the contrary happens, for so soon as the Vessels are a little cooled, the Blood they contain loses its Spirit, and is half coagulated; so that by its being thrust thus into the Liver of the Child, it is capable to cause several very great Accidents, not by its Abundance, but because having entirely lost its natural Warmth, it is soon corrupted; and happening to be mixed with that of the Child, it spoils it; for if the Child should want Blood to strengthen him, it should be a good and laudable Blood, and not a Blood half coagulated, and destitute of its native Warmth. Therefore, whether the Child be weak or strong, the Blood of the Navel-String must not be thrust into the Body.

Note, also, That some good old Women are superstitious enough, especially here in *England*, to believe that the Ligature of the Navel-String is to be made, nearer, or further from the Belly of the Child, according to the Difference of the Sex; that to Boys it should be made two large Fingers distant from the Belly, at least, that they may have their *Penis*, as they call it, longer; and to Girls much nearer, because thereby drawing the Matrice further inside, it remains deeper, and the *Vagina* narrower, which is a mere Abuse; for in what Place soever the Navel-String be tied, whether nearer or further, was it even half a Foot long, it parts always at the same Place, *viz.* joining the Belly; because it is a Part which remains entirely unanimated, after the Child is out of the Matrice; besides, that the Ligature can neither relax, or draw in either the Yard of the Male, or the Matrice

Matrice of the Female; since those Parts have no particular Communication with the Navel-String of the Child.

Note, besides, That the next Thing I must teach my Pupil Midwife, is *the Manner of washing the Child of his Excrements; and of dressing him.*

After the Midwife has dressed the Umbilick of the Child, she must carry him to the Fire, to cleanse him of his Excrements; of which some are inside, *viz.* the Urine and *Meconium*; and others outside, which are a Kind of whitish and unctuous Scurff, proceeding from the Slime of his Waters. — This *Scurff* must be washed off with Wine and Water, a little warm; and if it was much adherent, some fresh Butter should be melted in the warm Wine and Water, or some Oil of sweet Almonds, which is still better, added to it. To use this Mixture, the Midwife must dip a Piece of a soft Cloth, or a soft Sponge into it, and with it wash the Child all over, particularly the Places which are the dirtiest, as the Head, the Groin, and under the Arms, cleansing the Ears and Nostrils with small Tents of Linen roul'd; as for the Eyes, they ought not to be washed with the Wine, for fear of making them smart; but they must be cleansed with a Piece of dry Cloth.

The Child, thus washed and cleansed of his Immon-dices, must have afterwards all the Parts of his Body carefully examined, to see if they be not vitiated; if some of them be not dislocated, or broken; if his Nose be streight, if he be not Tongue-tied, if he has not some Contusion on the Head, and if the Bones thereof be not awry, if the *Scrotum* (in case he is a Boy) be not swelled and tumified; in short, if he has suffered no Violence in any of the Parts of his Body, and if they be well conformed, in order to remedy it, according to the Nature of the Indispositions.

But as it does not suffice to have cleansed the Outside of the Body of the Child, one must take particular Care besides that he may ease himself of the Excrements retained within; in order to which the Midwife must see if he has the Conduits of the Urine, and of the Anus well open; for Children have been born without being perforated, who died for Want of voiding their Excrements, because the Midwives had not minded it soon enough. As to the Urine, all Children whether Males or Females, void it as soon as they are born, and particularly when they feel the Heat of the Fire; and sometimes likewise the *Meconium* of the Intestines, but most commonly a little later, if the Child was to keep it longer than twenty-four Hours, some small Suppository should be thrust into his Fundament, to excite him to void it, lest it should gripe him much; a Stalk of Parsly rubbed over with Honey, or Oil, or Fresh Butter, is of great Service on that Occasion, making him take besides, some Syrop of Roses, or of Marshmallows, mixed with Oil of Sweet Almonds. It is known that the Child has voided all the *Meconium*, when the Excrements change Colours; which most commonly happens the second or third Day.

Note, That it would be in vain to give here any Directions how to dress the Child after it has been washed, and carefully examined, since all Midwives, and even Nurses, let them be ever so ignorant in all other Things, must certainly know this; all I can say in general relating to it is, that particular Care should be taken to cover his Head so, especially the Mold, which is not invested with Bone yet, that he may not catch Cold, and not to roll him too tight on the Breast and Stomach; for if the Breast be too tight it obstructs the Respiration; and if the Stomach, it hinders the Coction of the Aliments, and causes a frequent Vomiting.

Note, also, That from this I'll pass to *the Regimen the Child is to observe, and how he is to be treated.*

The first Aliments which are to be given to a Child newly born, are either some Wine with Sugar, or some Fresh Butter with Sugar; but I prefer the Wine to the Butter, because it answers better the Purpose it is administered for; which is to incise, and make him evacuate the Phlegms he has in his Stomach, to hinder

the Milk, which he is to suck afterwards, from being corrupted, by being mixed with those Phlegms.

If the Child is to suck his Mother, it would be best to wait (if it could be done without any Prejudice to the Mother, or to the Child) till after the eighth Day of her Lying-in, that the Humours of her Body being well tempered, and recovered from the Agitation they have received during the Labour, as likewise their Superfluities having been entirely evacuated by means of the Lochia, her Milk be much more purified; besides which the small Holes of the Nipples being not yet very well unstopped, they are hard to suck in the first Days, during which Time the Child should suck another Woman. But as all lying-in Women, without Distinction, are not in a Condition to use all those Precautions, they must have their Breasts drawn first by some Woman, or a stronger Child than theirs, or they'll draw it themselves by means of a Glass Instrument made for that Purpose; till the Milk has made itself an easy Way through the Breasts, and can be sucked without Difficulty by her own Child.

Note, That some are of Opinion, that the Milk proves more beneficial to the Child at first, than if it was purified, since it serves to keep his Belly open, and to purge the *Meconium*; I am likewise of that Sentiment, as to that Effect; but by its not being easily digested in the Stomach of the Child, if he may be suffered to suck some of it, it must be but in a very little Quantity, and to answer only those Purposes; otherwise that Sort of Milk being of a very difficult Digestion, would much weaken the Child's Stomach, and cause very frequent Vomiting afterwards of the best prepared Milk.

If the Nurse has a great Quantity of Milk, she must give no other Viſuals to her Child, for two Months at least: And as to the Quantity of the Milk a Child should suck, it must be proportioned to his Age and Strength, never so much in the first Days, nor so often; that his Stomach not used yet to the Coction thereof, may digest it better; increasing by degrees till he be suffered at last to suck his Fill. As to the Time and Hour it cannot be limited, since he may suck at any Hour of the Day or Night, when he pleases; for it is best it should suck little and often, rather than to over-load his Stomach at first, which being incapable to contain so much Milk, would be forced to vomit it; notwithstanding which, it would be very proper if possible to use the Child to suck but every two Hours in Day-time, and never at Night but when he awakes of himself.

Note, That I have seen Women, both in *France* and *England*, who though of a very strong Constitution, very healthy, and having Abundance of Milk, had the Cruelty to refuse suckling their Children, because truly they would not be disturbed in the Night, or their Husband, say they, would not have their Breasts spoiled; therefore abandon those innocent Victims of their Sensuality and Cruelty, to the Care of a strange Woman they often know nothing of but by Report, who it is almost absolutely impossible should have the same Tenderneſs for other Children she has for her own, though she must, if she designs to nurse them as she ought. Hence so many Skeletons of Children, so many Cripples, and so many of them murdered, through the Negligence of Nurses, and the Inhumanity of Mothers. For how can they expect, if they, of whose Substance those Children have been formed in Part, have no natural Inclination for them, and rather chuse to put their Life in Danger than to discompose themselves, that a strange Woman who is nothing at all to a Child, but what Lucre makes her, will not use the same Precautions, and consult as much her own Ease? I must however do this Justice to the *English* Women, that more of them suckle their own Children, and even Ladies of the first Rank, than of my Countrywomen; for in *France* none but the poorest Sort, and those who are not in a Condition to pay a Nurse, suckle their own Children, it is even a Mark of Poverty to do it, of which Persons above the common Sort, would be ashamed.

After the Child has been fed with the Breast only,

for two or three Months, more or less, as it will be thought proper; having a greater Regard on those Occasions to the Strength of the Nurse, and to the Abundance of her Milk, than to any other Considerations whatever; for if the Nurse be strong and healthy, and has a great Quantity of Milk, and her Child on the contrary be puny and weak, she should suckle her Child as long as possible; since all other Aliments, let them be ever so good, discompose always more or less his Stomach. But if the Nurse be weak and has but little Milk, she must give her Child Pap, at first but once, or to the utmost twice a Day, and in a little Quantity, to use his Stomach to it, giving him the Breast soon after he has eat it, to help to the Digestion thereof.

Note, That there are different Manners of making Pap for Children: In *France* they make it with Flour and Milk, and to render the Flour of a more easy Digestion, they put it to bake in the Oven, then mix some of it with Milk, to make of that Mixture what the *English* call Thick Milk. My Opinion is, that this Sort of Pap, when made pretty thin, and well boiled, so as to smell no more of the Flour it is made of, and when poured on a Silver or Pewter Plate, to part from it, without soiling it, like a Jelly, is a very good Food for a Child, if given in a little Quantity at once. For it does not fill him with Wind, and with so much Phlegm, as does the *English* Pap, made with Bread and Water, neither is it so much griping; and is much more strengthening.

Note, also, That I can by no means approve the Conduct of Mothers, who pretend to bring up their Children without the Breast, and, as they call it, by the Hand; for being thereby deprived of their first and natural Food, it is very rare that any of those thus fed are brought to the Age of Maturity: If those Mothers are forced to it through Want, or some other indispensable Necessity, I cannot blame them; but if they do it through Indolence or Self-Preservation, they are nothing else but sly and secret Murderers of their own Flesh and Blood; why do they marry, those Sorts of Women? or why do they get Children, if it is to kill them? Wretches, who to hide their Shame kill their Bastard Children, are put to Death (and well they deserve it) and those who kill them by Degrees, either to preserve their handsome Breasts, or for Fear of losing a few Hours Rest, are suffer'd to live.

When the Child has suckled sufficiently, the Nurse should put him to sleep in a Cradle, and not in the same Bed with her, for fear of over-laying him; an Accident which is very frequent here in *London*, where seldom a Week passes, without finding in the Bill of Mortality, five or six Children, more or less over-laid; occasioned, but too often, by the infamous Nurses making themselves drunk with spirituous Liquors. I am surprized, that the Legislature takes no Notice of that destructive Evil, and makes no Law for the Punishment of Nurses who over-lay a Child, by suffering themselves to be intoxicated with Liquor, for they certainly deserve Death as much as a Man who shoots another thro' the Head.

There is no Term limited for the Repose of a Child newly born, for he may sleep at any Hour of the Day and Night, when, and as long as he pleases, since the longer he sleeps, especially in the first three Months, the better he has his Health; though when it is observ'd, that his Sleep exceeds a certain Mediocrity, the Nurse may awake him by taking him gently in her Arms, singing to him softly, not hollowing in his Ears, as I have seen some Nurses do, which is enough to throw a Child into Convulsions, and shewing him the Light. It must be observed, likewise, that while in his Cradle, or on his Nurse's Knees, his Face should be turn'd towards the Light, which is in the Room, that he may not be oblig'd to turn his Eyes sidewise; and contract thereby the ill Habit of squinting, which is very disagreeable; which to avoid, it is best to cover the Cradle with something, to hinder him from seeing the Light, because his Sight being thereby fixed, without vacilling on either Side, is much more strengthened. — Let's examine next how the

Nurse must cleanse the Child of his Excrements, or as they vulgarly call it, turn him dry.

A new-born Child must be turned dry, at least three or four Times a Day; or to speak better, as often as he soils himself, without leaving him any Time in his Excrements, unless he be asleep. This Operation must be done before the Fire; and the Cloths very warm and dry, before they are put to him, for if they were damp, and cold, they would cause him the Cholick and Gripes. When she undresses him quite, which must be done twice a Day, at least, she must put small Pieces of Cloth behind his Ears, and under his Arms, to suck the Humidity of those Places. Examining every Time very carefully, if the Ligature of the Navel-string be not loose, and if the Blood does not flow from it. And when it is quite fell, she must continue to keep the Navel tight with a Belly-Band, leaving a Compress over it, till it be well cicatrized, quite depressed, and drawn inside.

The Nurse must also take a particular Care, that her Child may not cry too much and too long, especially the first Days, for fear his Navel should start out, and there should happen by its Dilatation an *Exomphale*, or a Rupture; without minding what old Women say, that it is best to let him cry to purge his Brains. The two best Means to appease him when he cries, is to give him the Breast, and turn him dry; she must also endeavour to shew him something capable to divert him. — They must not pretend to suck or press the Breasts of the Child, under Pretence of forming the Nipples, if they be Girls, or to draw out some Serosities, which are in them; for such a Thing causes often very painful Tumours in those tender Parts.

Note, That all I have said relating to the Regimen, and nursing of a new-born Child, must be understood only of those who are in perfect Health; for if some Indispositions happen to them, they must be treated according to the Difference of those Indispositions, and to the Directions I am a going to give relating to them; beginning by the *Weakness of the Child*.

The first Accident to which a new-born Child is subject, is Weakness; not that they are always weak of their Nature, but it proceeds from a hard or tedious Labour, during which they have suffer'd so much, that they are sometimes so weak after they are born, that it is difficult to discover at first, if they be alive or dead, because they are not seen to move any Part of their Body, which is sometimes so blue and livid, particularly the Face, that they are thought to be quite suffocated; tho' after they have been whole Hours in that Condition, they recover by Degrees, as if they were returning from Death to Life.

One may judge that the Child is not actually dead (though in some Measure he appears so at that first Instant) if the Mother has felt him stir with Vigour, a little before she was deliver'd, if she had not too great a Flooding, and if her Labour was not extremely hard. But one would be quite convinced that he is alive, tho' he does not cry, and does not move any Part of his Body, after he is born, if putting the Hand on his Breast, the Motion of the Heart is felt; and if feeling the Navel-string, near the Belly, there is yet a Pulsation of the Arteries; then all Endeavours must be used to bring him to Life. — First, being put in a warm Blanker, he must be carried to the Fire, where the Midwife having taken some Wine in her Mouth, shall squirt a small Quantity thereof into his, repeating the same Thing if it be necessary; putting, likewise, on his Breast and Belly other Compresses, dipped in other Wine, which must be warmed for the Purpose; keeping his Face uncovered, and his Mouth a little open to facilitate his Respiration, cleansing his Nostrils with small Tents dipped likewise in Wine to make him smell it, warming all the Parts of his Body, to excite in them the native Warmth, and accelerate the Circulation of the Blood and Spirits; whereby the Child recovering his Strength by Degrees, will begin to move his Members one after another, after which he'll cry, though very weakly at first.

Sometimes, also, Children are naturally weak, as

when they come before Term, or have been begotten by infirm or weak Parents. In that Case, it is very difficult to remedy to it, and all that can be done, is to nurse them well; notwithstanding which, such Children are seldom of a long Life, and often die of the least Indisposition which happens to them.

As to the Contusions and Bruises of the Head and other Parts of the Body of a new-born Child. — The most common and most frequent *Contusion*, is that made at the Top of their Head; where they have, sometimes, at their coming into the World, a *Contusion* as big as half an Egg, or even bigger; as is particularly seen in the first Lyings-in, which happens much sooner when the Woman is advanced in Years, because the inward Orifice of their Matrice being more callous, is dilated with greater Difficulty; wherefore the Head of the Child happening to be pressed against it, and being encircled with it as with a Crown in its superior Part, which presents itself naturally foremost, is swelled and tumified because of the Blood and Humours which fall and are stopped in that Part by the Compression thereof made by that inward Orifice, and particularly when it begins to be pushed out strongly, and remains thus too long without being capable to make her Way, after the Waters, which supported it a little, have been evacuated, to which the Midwife can contribute, likewise, if she touches it too often, and too roughly with her Fingers, when it presents itself to the Passage.

Those Tumours are sometimes so big, that they can (the Woman having not yet the Orifice of the Matrice sufficiently dilated) hinder a Midwife from knowing easily, which Part the Child presents foremost; mistaking those Tumours for a Shoulder, a Knee, or the Buttock of the Child; though by feeling it, the Mistake is soon rectified; for though those Tumours are very fleshy, they notwithstanding feel harder than a Shoulder or the Buttocks, those Parts being always much softer, and have not those Hairs felt on the Head. If the Child presents first any other Part than the Head, as an Arm, or a Leg, and those Parts remain likewise a long Time pressed in the Passage, they are also tumified.

To dissolve those Tumours, so soon as the Child is born, they must be bathed with warm Wine, or Brandy, dipping a Compress in it, to put over the Tumour, or Bruise; and if, notwithstanding, they were to come to a Suppuration, the Matter ought not to be left to sojourn long in it, for fear the Bones of the Head, which are very tender, and very thin in new-born Children, should be altered and cariated, in which Case the Tumour must be opened in a proper Place, applying over it a Plaister of Betony. If an Arm or a Leg was tumified, likewise, it must be wrapped in Compresses dipped in Wine or Brandy, in which have been boiled Camomile-Flowers, or Mellilot. Which Remedy is likewise of very great Service, when Boys have their Scrotum swelled.

But the greatest Accident is when a Man-midwife, or a Midwife, through Want of Skill, or Dexterity, breaks or dislocates an Arm or a Leg; which Accident must be remedied, by setting the Member in its Place again, and keeping it up with proper Bandages.

As to the Mole of the Head of new-born Children, and Sutures too much open. — Often Children born before Term, having not yet acquired their entire Perfection, as likewise those weak of their Nature, have the Mole of the Head, and the Sutures so open, proceeding from the Bones being at a great Distance from one another, that it is quite soft, and almost without Support, because its Bones vacillate on all Sides. These Children most commonly do not live long; and one must not pretend then to approach the Bones near one another, by a too close Compression, otherwise the Brain would be thereby deprived of its Motion by being too narrowly confined; therefore the Midwife must only take care then to keep up gently, and without the least Violence, the whole Structure, by Means of a Beguin, and leave the rest of the Operation to Nature, which will join those Sutures by Degrees, in generating, drying, and consolidating the Bones of the Head, which had not been yet entirely formed.

Note, That there are Children who have the Mole of their Head open, till they are three Years of Age;

and even sometimes after that Time; which is a great Sign of the Weakness of their natural Warmth. It is most commonly entirely closed, at the End of two Years, sooner or later, according as the Children are more or less humid, and more or less strong. Till those Bones be entirely consolidated, it is the Practice in France to have on the Place a Compress of Cloth, in several Doubles, to defend the Brain against the Cold, or any other external Injury.

It sometimes happens, that though the Bones of the Head be large enough to be joined on all Sides, if they were not hinder'd from it; they are notwithstanding very distant from one another at the Place of the Sutures, because of the Quantity of Water contained between them and the *Dura Mater*. This Malady is called *Hydrocephale*, of which there are several Sorts, according as the Waters are nearer or more distant from the Brain, or even contain'd in its Ventricles. If the Waters are between the Skin and the *Pericranium*, or between the *Pericranium* and the *Cranium*, the Malady may be cured, if the Tumours be not too large, by dissolving the Waters, or making an Aperture for the Evacuation thereof; but if they be in too great Abundance under the Bones, between them and the *Dura Mater*, pushing them thus outwards, and widening the Sutures, Children cannot recover; which is still much more impossible, if those Waters be contained between the *Dura Mater* and the *Pia Mater*, or in the Brain.

As to new-born Children who have their Fundament closed. — It happens, sometimes, that Children, both Male and Female, are born with their Fundament closed and stopped, wherefore they cannot void their Excrements; of which Malady they infallibly die, if it be not quickly remedied.

The Fundament is closed in two Manners, either by some simple Membrane, as by the Skin, through which some Trace is seen, or a livid Mark proceeding from the Excrements retained; and there is felt with the Finger a Softness in the Inside, at the Place where it should be perforated. Or it is entirely closed by a Thickness of Flesh, so that nothing appears outward, which could denote its true Situation.

When nothing but a Skin stops the Fundament, the Operation is easy; and Children can recover, by the Surgeon making the Aperture thereof, with a small Bistoury, rather cross-wise, than single or longitudinal, to give it a round Figure, and that the Place may not be reunited afterwards, taking a particular Care not to wound the Sphincter of the *Rectum*. The Incision thus made, the Excrements will have an Issue, but if they could not be evacuated, by their having grown too hard, in sojourning so long in the Belly, a gentle Glyster ought to be administer'd to the Child, to excite that Evacuation; after which a Tent must be introduced into the *Venus* to hinder the Re-union thereof, which should be cover'd at first with Honey of Roses, and at the End with some desiccative and cicatrizing Unguentum, as the *Album rasis*, and the *Pompholix*; taking particular Care to cleanse the Child well of his Excrements, and to dress the Wound immediately after, and every Time he goes to stool, lest by leaving him too long weltering in them, the Wound should degenerate into a malignant Ulcer.

But if the Fundament be so closed, that there is not the least Trace or Mark thereof remaining, the Operation is much more difficult; and it is a very great Hazard if the Child escape with Life. Therefore if it be a Girl who voids her Excrements through an Aperture which Nature has made in the Inside of the *Vagina*, to supply the Want of an Anus (as it often happens in those Cases) the Operation ought not to be attempted, lest that wanting to cure only an Incommodity, one should procure the Death of the Child: But if there be no Issue for the Excrements, the Operation must be undertaken, though very dangerous, since without it the Child would infallibly die.

To operate well, in this Case, though there be no Trace seen on the Outside of the proper Place, because of the Thickness of the Flesh, which covers the Intestine, the Surgeon shall introduce as far as into the *Vagina* a small Bistoury edged only on one Side, turning the Bistoury

of the Instrument underneath, and at half a Finger's Breadth of the Rump-bone of the Child, which is the Place where he shall find the Intestine; and pushing it so far, that it may be wide enough for the Evacuation of the Excrement, taking Care to preserve as much as possible the *Sphincter*; this done, the Wound shall be dressed as above; having Regard to the Accidents which could follow.

When it happens that the Conduct of the Urine is stopped, it must be open'd likewise to give Issue to the Urine contained in the Bladder; after which a small Lead Pipe shall be introduced into it, to keep the Passage open, till the Punction and Incision, which has been made with the Lancet, be cicatrized. But as it is very difficult to keep such a Pipe in the Yard of small Children, on which, by its being too short, a proper Bandage cannot be applied, it is as well without it, since the Urine they void, almost continually, will keep the Aperture open.

Note, That the next Accident I design to examine in a new-born Child (though not at all dangerous, though it would be very troublesome and disagreeable, if it was not remedied in Time) is that commonly called in *English*, *Tongue-tied*, and in *French*, *Le filet*.

The Tongue is naturally fasten'd with a pretty strong Ligament, which fastens it underneath, and is extended as far as the Middle thereof, to keep it subject, and to serve as a Pivot, on which being supported, it may make on all Sides all its different Motions. That Ligament must leave it the Liberty to be carried into all the Parts of the Mouth; therefore it must not be too short, nor fasten'd, but at a reasonable Distance from its Extremity, which must be free on all Sides. But it happens often, that new-born Children have on the fore Part of that Ligament, a small membranous Production, continued almost as far as to the End of their Tongue, which depriving them of the Liberty of its Motion, hinders them from sucking with Ease; because the Tongue being kept down, and as bridled by that String, he cannot raise it as it would be necessary, to press with it the Nipple against his Palate, and suck it to draw the Milk from it; nor likewise move it commodiously for the Deglutition of the said Milk.

To rectify that Imperfection, a Surgeon must cut the String as much, or as little, as he'll judge necessary, with Scissars very sharp at the Point; avoiding above all Things from making the Incision of the proper Ligament of the Tongue, as likewise from Opening the Vessels which are underneath.

Note, That when a Surgeon, or a Midwife, through Ignorance, or Want of Dexterity, in attempting to cut the String above-mention'd, opens the Vessels which are under the Tongue, there ensues an Hemorrhage, which would infallibly cause the Death of the Child, if it was not soon stopped; therefore when such an Accident happens, the Surgeon must heat the End of a single Probe, to cauterize the Vessels which are open.

After the String has been cut, the Nurse must pass her Finger two or three Times a Day, under the Tongue, to hinder the Re-union of the Part cut; but it must be done very gently, for fear that by irritating that small Wound, an Inflammation should happen, which afterwards could degenerate into an Ulcery.

As to the Gripes which new-born Children are subject to. This is often the first and most common Malady which happens to Children after they are born, which makes them cry Day and Night, through the excessive Pains they feel in their Belly, and which sometimes causes their Death; which Malady proceeds most commonly from the sudden Change of the Food of the Child, and of the Manner of receiving it; for while they are in the Matrice, they are fed through the Navel-string of the Substance of the Mother; and when born, they suck their Aliments with the Mouth from her Breasts, of which are generated much Excrements; because the Stomach cannot digest well those Aliments, nor the Intestines make a Distribution thereof, at first, by not being yet used to them.

Besides this general, there are other particular Causes

of this Malady, *viz.* the Want of evacuating the *Mæconium*, which grows hard, and pricks the Intestines with its Acrimony; the Child sucking more Wind than Milk, by the Difficulty it meets with in drawing the Breast, either from his being too weak, and the Breast too hard; which Wind sliding into the Intestines, make a painful Distension thereof; but those Gripes proceed oftener from giving too much Pap to the Child, or from that Pap being not done enough; because that Food which is coarse and viscous, cannot be easily digested by new-born Children, who have not yet their Stomach used to it.

To remedy the Gripes which torture new-born Children, Regard must be had to the different Cause thereof. Therefore, if they proceed from Change of Food, the Child must be kept from sucking till he be two or three Days old, for fear the Milk should be corrupted, by being mix'd with the Phlegm which he has then in his Stomach; and at the same Time some Oil of sweet Almonds extracted without Fire, and mixed with Syrup of Marshmallows, must be administer'd to him, to incise those Phlegms. If from the *Mæconium*, which is stopped and harden'd in the Intestines, the Evacuation thereof must be procured by Means of some laxative Syrups, as that of Roses, or *Rhubarb cum Chicor.* &c. If the Child cannot suck easily; Regard must be had to what hinders him from it; for if it be by his being Tongue-tied, the String must be cut off; or from that the Breasts of his Nurse are too hard, he must have another Nurse, whom he shall suck a little at a Time and often; since his Stomach cannot contain and digest much Milk at once: And while he is griped he must eat no Pap, because that Food causes by its Viscosity Obstructions, whence Winds are generated, which increase in such a Manner the Pains of the Gripes, that it causes mortal Convulsions in several Children.

If the Child has Worms, a Piece of Cloth dipped in Oil of Wormwood mixed with the Gall of an Ox, must be applied on his Belly; and if he can take any Thing inwardly, I have prescribed a weak Infusion of Rhubarb in red Wine, which has very well succeeded.

When the Gripes are caused by the Winds, as it most commonly happens, or by some acrimonious Humours contained in the Intestines, the Belly of the Child must be anointed with the Oil of sweet Almonds, Walnuts, and Camomile mixed together, and warm, dipping a Piece of Cloth to put upon it, keeping besides the Child very warm.

As to the Inflammation, Ulceration, and Eminence of the Navel of new-born Children.—The continual Cries of small Children, occasioned by the excessive Pains they feel at first, cause them so much Agitation in their Belly, that the Navel-string happening to fall too soon, and before it be entirely re-united and cicatrized, there happens an Inflammation and Ulceration in the Place; at other Times, though it be entirely re-united outwardly, but not inwardly, it dilates itself, and starts out of the Bigness of a small Egg, and sometimes more; which we commonly call *Exomphale*, or *Eminence of the Navel*.

Some imagine that when it is thus inflamed and ulcerated, it is because the String has been tied too near the Belly, which causes a great Pain, and afterwards an Inflammation; others say, that Nature being used to void the Urine through that Place, while the Child is in the Womb of his Mother, sends it thither still during the first Days, and causes that Accident by its Acrimony; which Sentiment has not the least Appearance of Reason; for it is impossible that the Urine should flow from the Bladder to the Navel through the *Ouraque*, which is not perforated in a human Fœtus; and let the Ligature of the Navel-string be ever so near the Belly, and so tight, it being a dead Part, so soon as the Child is born, it cannot hurt it, unless the Skin of the Belly, which is very sensible, be tied along with it.

Therefore this *Inflammation* and *starting out* of the Navel-string proceed from that the Child feeling violent Pains in his Belly cries continually, whereby the Umbilick is hindered from re-uniting itself; it can proceed likewise from a violent and frequent Cough, because by the violent Efforts thereof the Blood is forced into that End of the umbilical Vein which is left, which it keeps always dilated, and happening to be corrupted by its long Tjourning in it, it infallibly causes an Inflammation

to the Navel; and what is tied happening to fall before the Re-union is made, there remains an Ulcery in the Place, which is often followed by a Loss of Blood, and sometimes even by Death.

The chief Thing to be observed in the Cure of this Malady is, to endeavour to appease the Cough and the Cries of the Child, having Regard to what can be the Cause thereof, otherwise it would always increase; and if he was griped he must be eased as above prescribed. If there be an Inflammation of the Navel, a Plaister of the *Cerat* of *Galian*, mixed with half *Populeum*, or a small Compress dipped in Oil of Roses, and a little Vinegar, must be applied to it: *Unguentum* of Roses and *Album rasis* mixed together, are also very good. If the Navel remains ulcerated after the Ligature is fallen, astringent and desiccative Remedies must be applied to it, such as small Pieces of Cloth dipped in Lime-Water, or Plantin-Water, in which some Allum has been dissolved. If the Ulcer be small, nothing but a Pledget of dry Lint should be used.

As to the *Eminence of the Navel*, whether it be big or small, the Cure thereof ought not to be undertaken otherwise than by the Bandage, and Compresses, which must be well appropriated to that Use, till the Child has acquired a pretty reasonable Age; when, if the Malady was not cured by the Bandage, the Operation may be attempted; but if in Consequence of the Inflammation of the Navel, an Imposthume was formed in it, which causes that Eminence, and the Tumour being very big, the Child can never be cured, and infallibly dies of it. For if the Tumour be opened, tho' the Matter will be thereby evacuated, there is great Danger of the Intestines coming out along with it, the first Time the Child cries after the Operation is made; therefore *Ambrose Paré* would not have a Surgeon attempt it, for Fear of being accused by those who know nothing of the Matter, with having killed the Child; though this Advice of *Paré* is to be followed with a Distinction; for if the Imposthume be small, and the Strength of the Child will allow it, the Operation is to be made, because when there is some Hope of Success, let it be ever so little, it is best to practise what the Art commands, than leave the Patient in an imminent Danger of his Life.

As to the *Soreness, Redness, and Inflammation of the Groins, Buttocks, and Thighs of the Child*.—If the Nurse does not keep her Child very clean, by changing his Cloaths every Time he has fouled himself, his Groins, Buttocks and Thighs will be subject to Excoriations, which often degenerate into Inflammations. To avoid which the Nurse must not only change her Child often, but also keep those Places very dry, and free from all Sorts of Humidities, and if notwithstanding her great Care, those Parts, by their being very tender, should happen to be galled, she must wash them with cold Water, which I know to be the most sovereign Remedy in those Cases; some use when there is a great Soreness, *Album rasis*, or *Pompholix* spread on small Pieces of Cloths in Form of a Plaister. But when that Accident happens through the excessive Heat of the Urine of the Child, his wet Nurse must use a cooling Regimen, avoiding all that could contribute towards over-heating her Milk, especially those scandalous Cordials so much in Vogue at present among the fair Sex.

Another Malady to which new-born Children are subject, as the *Aphtes*, or *Ulceries*, or *Cankers of their Mouth*.

The *Aphtes* proceed either from the Milk of the Nurse, who being red-hair'd, or amorous to Excess, or addicted to Wine, her Milk can by its Heat and Acrimony ulcerate the Mouth of the Child; or from the Milk being corrupted in the Stomach of the Child, through the too great Debility of that Part, or some other Indisposition, in which acquiring an Acrimony instead of its being well digested, there arises from it a viscous Scurf, which adhering throughout the whole Capacity of the Mouth, generates in it those little *Ulcers* or *Aphtes*.

Some of those *Aphtes* are simple, as those caused by the sole Heat of the Milk of the Nurse, or by the Blood and Humours of the Child, which are a little too much over-heated: Then they are very superficial, and of a

short Duration, and easily cur'd; and others are malignant, such as those caused by a venereal *Virus*, or those which happen after a malignant Fever, or partake of the Nature of Scurvy, which are putrid, corrosive, and ambulant, and occupy not only the Superficy of the Membrane which lines the Inside of the Mouth and all the Tongue, but making deep Excoriations, are communicated besides to all the inward Parts of the Throat, which are the Properties of all those caused by the *grand Pox*, which cannot be cured by the common Remedies, but by their Specificks, otherwise they would grow worse every Day, and cause at last the Child's Death, often too weak to bear the Effects of the Remedies which are proper to save his Life.

When those *Aphtes* are small, and without any Malignity, by washing the Mouth of the Child with Barley or Plantin-Water, mixed with Honey of Roses, or a Decoction of the young Buds of the Leaves of Blackberry-Trees, which is a Remedy of my own Invention, and which I know by Experience to be an excellent one, especially if a Spoonful of common Honey be boiled in it, and well skimmed, the Nurse must dip a Piece of very soft Cloth tied to a Stick, into this Decoction warm, and wash the Mouth of the Child gently with it; for if she was to go too roughly to work, an Inflammation would happen, which would render the Malady worse.

If the Ulcers were to participate of some Malignity, topick Remedies must be used, whose Operation should be very quick, to correct the bad Quality of the Humour which causes them, and hinder them from growing worse; because as they cannot be left long on those Parts, their Effects and Virtues would be hindered or much diminished by the Humidities of the Mouth, which Remedies must be escharotick: Therefore those Ulcers must be touched with some *Second Water*, mixed with Plantin-Water, or with some Spirit of Vitriol, taking great Care that the Child should not swallow any of it, and the Remedy ought to be much more strong and acrimonious as the Ulcers are deeper and malignant; being cauterised thus, by touching them simply once or twice, according to their Breadth, Depth, and Corruption (lest some acrimonious Serofities should distil on the Places which are not ulcerated, and into the Child's Throat) his Mouth must be washed with my Decoction of Buds of Blackberry-Bushes, and Honey of Roses, and touched afterwards with Lime-Water; tho' several prefer to this last Operation the cauterizing those Ulcers with small Tents dipped into boiling Oil. But if those Ulcers proceed from a venereal *Virus*, those Remedies can hinder them from proceeding further, but they cannot be cured without the Specificks I am to mention hereafter.

As to *Children breeding their Teeth with Pain*, and to *their Convulsions*.—Their Teeth which were hidden in the Jaw-Bones, begin commonly to come out, not all at once, but one after another, towards the fifth or sixth Month, sometimes sooner and sometimes later, piercing the Gums they were covered with. Then because of the exquisite Sense of those Parts, Children feel such excessive Pains, that a great Number of them, who before had always continued in perfect Health, are in great Danger of their Life, and often die, by reason of several bad Accidents which happen to them at that Time, the Principal whereof are mentioned by *Hippocrates*, *lib. 25. l. 3*. 'When, says he, the Teeth begin to sprout out in Children, there happens a dangerous Itching of the Gums, Convulsions, Looseness, and particularly at the coming out of the Eye-Teeth, in those particularly who are very large and fat, and hard bound.' Though the same *Hippocrates* says in his Book, *De Dentitione*, that all the Children who have Convulsions when they breed their Teeth don't die, and that several of them recover. He says likewise, that those who breed them in Winter recover sooner than at another Time, if they be well taken Care of.

The Eye-Teeth cause much more Pain to the Child than all the others, because they have a very deep Root and a more considerable small Nerve, which has Communication with that which moves the Eyes; and as *Hippocrates* observes, the Children who are very big and have their Belly very hard, are for that Reason

a much greater Danger than the others, because the Agony, in those, causes a much greater Fluxion of Humours on the sick Part. The Teeth which come out first are the *incisive*, either because they are sooner perfect, or because being smaller and sharper they sooner cut the Gums.

The Signs that a Child is breeding his Teeth are, that his Gums and Cheeks are swelled; where he feels a great Heat and an Itching, which makes him put often his Fingers into his Mouth to rub them, and he drivels a great Abundance of Humidities, which the Pains he suffers make to overflow his Mouth; the Nurse in giving him the Breast, feeling it much hotter than usual: He cries almost continually, and can have but very little Sleep, and the first Points of the Teeth are felt and seen through the Gums, which appear thin and whitish over them, and are swelled and red on the Sides; and if the Teeth have a great Difficulty to come out, or come out too many at once, the Child is in Danger, and if the Accidents which happen then do not cease, they often cause his Death.

Regard must be had on that Occasion to two Things; the first is, to preserve the Child from the sad Accidents which could happen by reason of the violent Agony; and the second, to facilitate as soon as possible the Cutting of the Teeth.

To preserve the Child from the Accidents he is exposed to, his Nurse must observe a good Regimen to cool and temperate her Milk, lest the Dentition should be accompanied with a Fever; and to hinder the Humours from flowing in too great Abundance on the inflamed Gums, his Belly ought to be kept open to evacuate them downwards; though this last Precaution is almost always needless, since there are but few Children who do not breed their Teeth with a Looseness.

As to facilitating the Cutting of the Teeth, that must be done by the Nurse, who must from Time to Time rub the Gums of the Child with her Finger, pressing moderately upon them, that being thereby rarified, they may be easier penetrated, and cut by the Teeth which are ready to come out; to which the Child himself can contribute, by giving them to mumble a Piece of Stick Liquorice, or of a small Wax-Candle, which is very proper to soften the Gums. The most common Thing given to Children on those Occasions, is a Coral set with small Bells, to divert the Child from the Pain he feels then; for one must not imagine with a Pack of old Women, that there is any particular Virtue in the Coral, which is of no other use in that Case but by reason of its solid even Matter, for the Child pressing his Gums against it to ease the Itching he feels in them, he thereby diminishes by degrees the Thickness thereof, so that they are insensibly cut by the Teeth underneath. But if all those Means prove inefficacious, by reason of the Hardness and Thickness of the Gums, to hinder the Child from falling into the Accidents he is threatened with, then a small Incision must be made with a Lancet, on the Gum which is disposed for it.

There are several other Remedies which some Persons imagine to have a particular Virtue to facilitate the Cutting of Children's Teeth; but as those Virtues are so very occult that no Body can account for them, are founded neither on Reason nor Experience, and have not the least Relation, nor the least Appearance of Sympathy with the Humours the Teeth are formed of, I will not amuse myself to refute all the nonsensical and ridiculous Prodigies falsely attributed to those Nostrums: For can any Body who has the least Notion of the marvellous Structure of the human Body, and of the Production of the several Parts thereof, be persuaded (unless he has made an entire Divorce with his Reason) that there can be any Thing in Nature, which applied outwardly can operate on an inward Part which is at a great Distance from it, and between which, and that outward Part it is applied upon, there is not so much as a Relation of Conveniency; for has the Anatomy discovered yet, in its most curious Researches, any Relation between the Parts which enter in the Composition of the Neck, for Example, and the Teeth? And if there be none, how can those Nostrums applied on the Neck, influence the Teeth as to facilitate their Cutting? Do they operate by Sympathy, or by Perspiration? If it be

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said that they operate by Sympathy, it is the same as if it was said that they do not operate at all; for even that Sympathy admitted (which I reject as frivolous, and founded only on the empty Reasonings of some crazy Philosophers) and which should consist in the Interchangeableness of the Corpuscles which flow continually from the Bodies, between which that Sympathy is pretended to subsist, which cannot be admitted, without admitting at the same Time an uninterrupted Continuity of those reciprocal Corpuscles; how could such a Continuity subsist between the outward Part of the Neck and the Teeth? When on the contrary they should make several Circumvolutions, and meet with almost inseparable Obstructions, which should absolutely hinder them from hooking in reciprocally one another. What could besides put into Motion and separate from their coarser Particles, the Effluvia, which should flow from those Nostrums to procure those prodigious Effects? Can it be the natural Heat? Has that Heat Power enough outwardly to operate with such Efficacy? And is that Power attractive and directive? For it should be both, to make the Effluvia of those Nostrums have the desired Effect; it should be attractive, to help those Effluvia's to conquer the Obstacles they would meet with in penetrating the Pores; and directive, to send them to the Place of their Destination; but far from that Heat being capable to operate outwardly, it is so far out of its Center when dissipated through the Pores of the Body, that it is thereby rendered imbecile and incapable of operating with the least Efficacy; and likewise, far from its being attractive, it is rather repulsive, since the greater it is, the more Power it has to expell the Humours through the Pores, which then it renders looser and wider: As to its directive Faculty, it has no other but that of contributing by accelerating the Circulation of the Blood to a more easy Separation of the Humours, and to the Exaltations of the vital Spirits, which it is impossible should have any immediate Effect on the Teeth, were even those Corpuscles to be introduced into the Mass of the Blood, and carried along with it in its Circulation, which is a ridiculous Problem.

As to the *Convulsions* little Children are subject to, they are caused either by the Gripes or by the Teeth. If by the Gripes, one must remedy to it according to our Prescriptions for that Malady; and if by the Teeth, the most salutary Remedy is to open the Gums with a small Bistory, till the Operator feels with the Point of the Instrument the Teeth which are disposed to come out, and to cut an Issue behind the Head of Children who have it very big; as likewise to keep the Body open of those who are hard bound, abstaining from giving them Pap for some Time. That dangerous Accident can also be prevented by bleeding the Child in the Arm when there is Plenitude, giving him some purgative Syrup, and anointing the hind Part of his Neck with Oil of white Lillies.

Most of the Indispositions of new-born Children are attended with a Looseness, to which contributes much the Humidity of their Belly, which is natural to them; and likewise the Aliments they use while they suck, which are very liquid and fluid, and consequently of a quick Evacuation.

That Looseness is often caused by their Teeth, whereby all the Humours are so much over-heated, that they are then much drougthy, wherefore they endeavour to quench their Thirst by sucking much more Milk than their Stomach can digest, where being corrupted, it never fails to cause them a Looseness: It can also proceed sometimes from the Vice of the Milk he sucks, which is too much heated.

If the Looseness be not accompanied with a Fever, or some other Accident, it is not dangerous, because it is an Indisposition agreeable to his Nature, and likewise to the Aliments he is fed with. But if notwithstanding it should continue too long, one must remedy to it, lest the Child, who is of a tender and soft Substance, very easy, if I may use the Expression, to be melted, should be too much weakened, by reason of a too great Dissipation of the Spirits, made by a too great Evacuation of the Humours.

Therefore the Child must suck but little at a Time, that

that his Stomach may the better digest the Milk; and be purged with that weak Infusion of Rhubarb in red Wine, heretofore mention'd, by Means whereof I have saved the Life of a Child five Weeks old, who had been given over by all those who had seen him. This Remedy alone suffices, without torturing the poor Infant with Glysters, or any other Remedies. To take off Part of the Bitterness of that Infusion, some Sugar-candy may be melted in it.

As to the vomiting of new-born Children. — It is an Accident which is more common to them than any other; and is therefore very little minded, unless it be too frequent and too violent; in which Case it must be remedied, for fear it should be attended with dangerous Consequences.

This *Vomiting* proceeds most commonly from Children sucking much more Milk than their Stomach can bear or digest, of which being over-loaded, it must be thrown out. That Accident proceeds sometimes, likewise, from the bad Quality of the Milk, or from the Efforts of a violent Cough, or from their Nurses dancing them too much, or too soon after they have sucked; for by those Motions the Milk being too much agitated in the Stomach, cannot be well digested. The Sweetness and Warmth of the Milk, contributes also much to all those Causes.

If the *Vomiting* be too frequent, it must be stopped, lest the Child should be much debilitated by so great and so frequent an Evacuation of his Aliments; and the digestive Faculty of the Stomach so much impaired, that it could not be easily restored afterwards.

For the Cure of the *Vomiting*, Regard must be had to the Causes thereof: For if it proceeds from that the Child sucks too much, the Nurse must not suffer him to do it, that his Stomach may easier contain and digest what he has sucked: If it be from the bad Quality of the Milk, the Nurse must be changed: If from a Cough, it must be checked, according to the different Causes whereby it is excited. Care must be taken, likewise, that he be not rolled too tight on his Stomach, that it may have the Liberty to extend itself according to the Quantity of the Milk it has received; besides which, if some bad Humours were contained in it, it would be proper to purge the Child with the Syrup of *Rhubarb cum Chicor.* and having been thus purged, some Syrup of Quinces shall be given him to rejoice his little Heart; applying on the Region of his Stomach, Pieces of Cloth dipped in burnt Wine. I have once prescribed to a Child but six Months old, fatigued with a frequent and violent Vomiting, two Drops of Laudanum, which had a marvellous Effect after all other Remedies had been attempted in vain.

As to the Ruptures of little Children. — Not to deviate much from our Intention, which is to observe only some Particularities relating to the Maladies of new-born Children, I will not attempt to explain all the different Sorts of *Hernies*; but I'll content myself with only examining slightly, that which most commonly happens to Children, which is the Intestinale, and is sometimes compleat in Children, as well as in Men, happening when the Intestine falls as far as to the Bottom of the *Scrotum*; and other Times incompleat, when it goes no farther than the Groin. The Rupture may be caused likewise, though very seldom, by the *Epiploon* falling into the *Scrotum*, either alone or together with the Intestine.

The most frequent Causes of the *Hernies* of small Children, are the violent Efforts they make when they cry or cough, to which contributes much the Humidity and Softness of their Body, as likewise their Belly being rolled too tight, because as it cannot then dilate itself in Width, when they happen to cry or cough, it is violently forced downwards, which occasions those *Hernies* or Ruptures.

This Malady should be remedied so soon as it is perceived, for the more it is neglected, the more it is difficult to cure; because by the continual falling of the Intestine, the Place through which it falls, is still more and more dilated: But if Children are more subject to *Ruptures*, than grown Persons, they are also much easier cured; because the Re-union of the Parts dilated is made with greater Facility, as well by Reason of their being

very tender, as because the Intestine being reduced and contained in its natural Place, while the Child grows bigger, likewise, in Proportion to the other Parts of the Body, and the Place of the Dilatation grows straiter by Degrees, by Means of the Compression of the Bandage applied upon it.

Some are of Opinion, that while Children are in their Swaddling-Cloths, the Cure of the Ruptures which happen to them, is not to be attempted otherwise than by the Bandage, which alone, say they, is capable to remedy either the compleat, or the incompleat. This Bandage is made of a Band rolled, putting a Compress directly on the Place of the Dilatation, having previously to it reduced the Intestine, and the *Epiploon* likewise, if it was fallen, in their natural Situation. Which to perform, the Child must be laid a-crofs the Knees of his Nurse, his Head pretty low, then with both Hands, the Reduction must be made by Degrees, pushing up gently the Tumour with one Hand, and with the other, placed directly under the Dilatation, reducing the Intestines, keeping up with it that Part which has been reduced to hinder it from falling back again, continuing thus till the whole Reduction be perfected; which done, a pretty thick Compress must be applied on the Place dilated, keeping it up by Means of a Bandage made in the following Manner. The Operator shall take a Band rolled of a Breadth and Length proportioned to the Bigness of the Body of the Child, round which it must make three or four Turns; placing first one End of the Band on the Belly of the Child, towards the Side opposite to that of the Rupture, carrying the Band afterwards under the Buttock of the Patient, then conducting it by raising it upwards over the Compress, and from thence under the Reins of the same Side, then round the Body: After which it must be carried back, as the first Time, continuing thus all the other Turns to the End; observing always, that the Circumvolutions which pass over the Groin, be made from downwards upwards, to rise up better, and pin them all with small Pins on the Compress, whereby the Bandage is kept more steady.

Note, That I have invented a Mixture, which can contribute to the entire Re-union of the dilated Part in ten or twelve Days, to keep the Intestine up, without the Help of a Bandage, which, let it be ever so well made, and so easy, is always very troublesome to the Child; this Mixture is spread on a Kind of Plaster, which does not fasten to the Skin; and which produces its Effect in 24 Hours, so as to hinder the Intestine from falling any more; so that the Operator is put but once to the Trouble of reducing the Intestine.

Note also, That this Accident is sometimes occasion'd by the Negligence of Nurses, in their refusing the Breast to the Child when he wants it, which throws him into violent Fits of crying, and thereby causes a Rupture. I was desired, some Years ago, by one Mr. Clark, a famous Taylor, in *Chancery Court, St. Martin's Lane*, to visit a Child he had at Nurse at *Twickenham*, whom I found afflicted with an uncompleat Rupture, having besides the whole Capacity of the *Scrotum* filled with Winds. I attempted the Cure by prescribing first what I judged proper to dissipate those Winds in the *Scrotum*; which could not be easily effected; for a few Days after I had seen the Child, he was taken with a violent Cough, which I was obliged to appease before I could expect to succeed on the other Side; but however, after much Care on my Side, I succeeded in both, so as to be capable to make the Reduction of the Intestine, and apply my Remedy; but though it had at first the Effect I expected, the Intestine fell back again, some Weeks after I had left off visiting the Child, thinking him then quite cured; therefore I was desired to visit him anew, and found this Time that this second Accident was caused by the Nurse being far gone with Child, and refusing the Breast to the Child, of which I informed the Father, who being insatuated with the pretended Honesty of his Nurse, would not believe at first, that she was with Child, till being convinced of it afterwards, removed his Child to another Nurse, where he was far better used, and soon after cured of his Indisposition.

Besides the true Ruptures above-mentioned, there are others, which cannot be properly called by that Name, because they do not happen by the Fall of any Part, but only by the Distension of the Membranes of the *Scrotum*, and of the Testicles, occasioned by the Matter which has been gather'd in them, either thro' the natural Debility of those Parts, or because they have been contused or pressed in a hard Labour; among which the watery and windy happen often; for the fleshy or varicose seldom or never happens in Children.

For the Cure of the watery, called *Hydrocele*, formed of the Waters contained either in the common or proper Membranes of the Testicles, Remedies must be applied on the Tumour, capable to dissolve the Waters contained therein, or to dissipate the Winds; after which the Parts must be strengthen'd. They must be dissolved with Fomentations of Brandy, or of a Decoction of Camomile, Melilot, Rue, Marjoram, and Fennel, in which Compresses must be dipped to apply on the Part, drying it afterwards with Lime Water, in which some Allum has been dissolved; and after the Resolution and Desiccation of the greatest Part of the Waters, the Parts ought to be strengthen'd by applying on them Compresses dipped in strong red Wine, boiled with red Roses and Allum; having regard always to the Cause of the *Hydrocele*, and to that which feeds it. But if the Remedies prove ineffectual, and the Tumour be extremely big, the Aperture thereof must be made for the Evacuation of the Waters, by the single Punction of the Lancet, which must suffice for young Children, who through the Imbecility of their Age, and the Delicacy of their Body, cannot bear another greater Operation for the Cure of the *Hydrocele*: And if even the Tumour was but moderately big, that Operation ought not to be made; for it is often cured and dissipated without any Remedy.

As to the Scab which sometimes covers the Head or the Face, and often both of young Children.—I design to speak here only of the Scab which has no Malignity, caused by the single Superfluity of some Humours, which being only heated, are easily carried to the Head and Face of the Child, where they form humid Pustules, in which those Humours sojourning are corrupted, and degenerate into a Sania, which corrodes and ulcerates afterwards the single Superficy of the Skin, from which it flows, and drying round the Place, grows hard, and forms those Crusts, vulgarly called *Scab*, where-with the Head and Face of some Children are cover'd all over.

Some are of Opinion, that this Scab, as well as the Meazles and the Small Pox, proceeds often from some Superfluities, and from the Residue of the menstrual Blood, which the Child evacuates after he is born, as an Impurity. But it is often caused by the Child sucking more Milk than he can digest, which is corrupted in the Stomach; as likewise by the bad Quality of the Milk, which generates a great Quantity of viscid and corrupted Humours which cause that Scab; which happens oftener to the Head and Face; because those Parts abound more in Humidities, particularly in Children, than any other of the Body.

If the Scabs be superficial, humid, and of a yellowish Colour, and if when risen, the Skin appears red, and without being deeply ulcerated, they are not malignant.

The Course of those Humours is by no Means to be stopped by Repercutives, because the Evacuation thereof is a Preservative against several other Maladies; and we most commonly see, that those whose Body has been very well purged of those Superfluities, are very healthy afterwards, therefore all that must be done in that Case, is to hinder the Child from generating any more bad Humours, by giving him a very wholesome Nurse, keeping his Body always open, and purging him, if it be necessary, with some Syrup of Roses, or of Chicory. For fear the Sania, stopped under the Scabs, happening to gnaw and corrode the Skin, should make some deep Ulcers, it is very proper to carry off those Scabs to facilitate the Evacuation of that Sania; which is done by rubbing the Scabs with fresh Butter, to humect them, or with a Liniment of Oil of sweet Almonds; after which must be applied on them Cabbage Leaves, changing them three or four Times a Day, to avoid the Stink

and Corruption of the Humidities those Things draw. These Remedies are to be continued till the Child be entirely cured. All that Time the Child's Hands must be tied, for fear that happening to scratch himself, because of the great Itching he then feels, he should excite an Inflammation in those Parts, by Means whereof a greater Quantity of Humours would flow.

Note, That my Method, in those Cases, is to purge often the Child, with gentle Purgatives, without fatiguing him too much, especially with Whey, in which has been melted some Pulp of Cassia; and when I perceive that the Scabs begin to dry, I have them cover'd over with a Piece of soft Cloth, dipped in my Stiptick, which must be dipped a-fresh every other Day, continuing thus the same Process for ten or twelve Days, at the End thereof the whole Cap will fall entirely off, and the Head or Face appear as clean as can be, without any Scar or Soreness remaining behind. This I know by Experience. Which Remedy is quicker in its Operation, surer in its Efficacy, than any of those above-mention'd; and not at all offensive.

As to the Small Pox and Meazles.—The *Small Pox* is a contagious Malady incident to Children; and likewise (though very seldom) to Persons advanced in Years, in which is seen a great Quantity of Pustules all semblable, to arise on the Superficies of the Skin, tending to Suppuration, and attended with a Fever.

The Origin of the *Small Pox* is uncertain: We find no mention of it before the *Arab* Physicians. It bears a great Resemblance to the Meazles; so that for the two or three first Days, it is difficult to distinguish them: They both arise from an impure Blood and other Humours which Nature expels, as in the universal Emonctory, to purge the whole Body of that Corruption: With this Difference, that in the *Small Pox* the peccant Matter is more thick and viscid; in the *Meazles* more subtil, hot, and bilious; and neither of them are known to return after having passed them once.

Doleus says, that the Cause of the *Small Pox* is brought into the World with us, and lies hid, till it finds an Opportunity of bursting forth. He adds, that there is scarce one in many Thousands, that escapes it all his Life.

Dr. *Drake* observes, that the *Small Pox* not being founded in any permanent habitual Disposition, has its Period within a limited Time necessary for the Extrusion of the peccant Matter out of the Pores of the Skin. For the salt Serum of the Blood being in this Disease, by an accidental Fever, thrown out in great Quantities on the Glands of the Skin, acts much after the Manner of *Lepa Arabum*; but when the Blood is despumated, the Scales dry and fall off. So that he thinks it would be no great Impropropriety to call the *Small Pox*, a temporary, critical *Lepa*.

The *Small Pox* are of two Kinds: The *distinct*, where the Pustules stand apart; and the *confluent*, where they run into one continued Cake.

The *distinct* or *regular Small Pox*, *Sydenham* observes, begins with a Shivering and Chillness, which is succeeded by an intense Heat, violent Pain of the Head and Back, Vomiting, Drowsiness, especially in Children, and sometimes epileptick Fits; which shew the *Pox* to be ready to burst forth, and that they will be mild; Weariness, and Pains in the Reins and Loins, Difficulty of Respiration, frequent Gapings, Sneezings, Pruritus, and Itching of the Nose, Redness of the Eyes, &c.

The Eruptions are usually on the fourth Day; upon which the feverish Symptoms vanish, except that Adults are prone to sweat. The Pustules first appear in the Face, then the Neck, &c. They are at first reddish, by Degrees swell and grow whiter: On the eleventh Day the Swelling and Inflammation of the Face vanish, and the Pustules begin to wither.

The Symptoms of the *distinct Small Pox*, as enumerated by Dr. *Shaw*, are, 1. A Pain in the Head, Back, and Scrobiculum Cordis. 2. A Fever which decreases as the Eruption increases, with Redness of the Eyes. 3. Nausea, and Reachings. 4. Little reddish Spots, or beginning Pustules appearing on the Neck, Face, Breast, &c. about the third or fourth Day inclusive from the Beginning of the Illness. 5. Restlessness. 6. About

the seventh or eighth Day, other little red Spots usually appear between the growing Pustules. 7. The Pustules about the ninth Day are at their State; being then generally as big as a large Pea, the Matter in them well concocted of a whitish Colour inclined to yellow; at which Time, 8. The Patient is usually light-headed, and feverish. 9. About the tenth Day the Pustules begin to dry on the Face. 10. And about the fifteenth, they appear shrunk, and begin to scale off; and now the Danger is esteemed to be over.

Note, That the distinct Kind is here consider'd unattended with a Looseness, and other Symptoms, which sometimes happen in it, as well as in the other.

Note also, That when this Sort of *Small Pox* is accompanied but with a simple Emotion of Fever excited from the single Ebullition of Blood and Humours; which ceases the very first Days, without any dangerous Accidents, growing ripe, suppurating, and being cured easily: The Pustules thereof are risen in Points, and their Matter white, even, and well concocted, the Children recover easily, and soon, when they are well treated. But there is another Sort which is totally malignant, and is that which proceeds from some contagious and pestilential Humour, the Pustules thereof are flat, brown, dark, and livid, having small, black Spots in their Middle; they come out slowly, and do not suppurate, or if they do, the Suppuration is bad, sanious, serous, and accompanied with dangerous Accidents, *viz.* a malignant Fever, Phrenzy, Difficulty of Respiration, Syncop, Dysenteria, and others, which very often cause Death, or at least malignant Ulceries, Caries of the Bones, Loss of Sight, and a great Deformity in the Face; or some Lameness, according to the Parts or Members of the Body, where those vicious Humours are carried and stopped.

The *confluent*, or *flux Small Pox*, have the same Symptoms with the *distinct*, only in a more violent Degree; they usually come out on the third Day, not separate as in the *distinct Kind*, but spread into one another, and at length appear all alike one whitish Pellicle over the whole Skin; after the eighth Day the Pellicle darkens. In Adults this Kind is attended with a Salivation; in Children with a Diarrhæa. The Salivation frequently succeeds immediately after the Eruption, the Diarrhæa later.

The Symptoms of the *confluent* Kind, according to Dr. *Sharpe*, are, 1. Violent Pain in the Head, Back, and Scrobiculum cordis. 2. Nausea and Reaching, with a Fever, which rather increases than decreases after the Eruption. 3. In Children a Diarrhæa, which usually precedes the Eruption, and attends the Distemper throughout. 4. A Ptyalismus in Adults, and but seldom a Diarrhæa. 5. Deliria, Convulsions, Hoarseness, Difficulty of Breathing, Fixedness of the Eyes, and Restlessness. 6. The Spots are here more red, thick, and close, than in the distinct; and the Species between them more inflamed and swelled; Purple or livid Spots also often appear in those Spaces, whence the *Small Pox with Purples*. At other Times in these Spaces, or on the Heads of the Eruptions, appear Bladders full of clear Water, vulgarly called the *White Bives*. Lastly, these Eruptions are frequently depressed in the Middle, and there turn black; whence the *black Small Pox*.

The Eruptions often rise and sink in the Progress of the Distemper; they usually first appear about the fourth or fifth Day, and come to their State about the fifteenth.

Alston divides the Disease into four Stages: The *Apparatus* or Preparation, from the Time of the first Infection to the Eruption of the Pustules. The *Eruption* which comprehends three States, *Eruption*, *Maturation*, and *Declension*, wherein the Pustules are first incruled with a Scab, then wither and dry off.

Note, That the Prognostick of the *Small Pox* is drawn from the different Cause thereof; for if the Fever be slight, and diminishes in Proportion as the Pustules come out, if those Pustules be not in too great Quantity, and grow ripe and white in a short Time, it is a good Sign. But if the Fever be strong at the Begin-

ning, and increases daily, with a Difficulty of Breathing, and other Accidents in Proportion as the Pustules come out, if they be in great Numbers, black, flat, dry, and without Suppuration, it is a Sign of Death. But Children are not in so great Danger in this Malady as the Adults, either because it is agreeable to their Age and Nature, or because having their Skin more tender, the Matter is easier expelled through it, than through that of Persons advanced in Years, who have it harder, and the Pores thereof less open.

As to the *Measles*, the Eruptions usually appear about the fourth Day like Flea-bites over the whole Body; but thicker and redder, and with greater Inflammation, than those of the *Small Pox*, and vanish in four or six Days after the Appearance, being, when at the Height, not larger than Pins Heads.

The *Measles* are more sickly than dangerous, though it often inclines to Consumptions by a Cough, which it leaves behind.

Note, That several very learned Men of all Ages, ever since the Discovery of the *Small Pox*, have attempted to account for its visiting a Person scarce above once, though none of them have been capable to do it to the entire Satisfaction of the learned World. Dr. *Drake* does it from the Alteration made in the Skin by that Disease: For, says he, the Distension the Glands and Pores of the Skin suffer therein is so great, that they scarce ever recover their Tone again, so as to be able any more to arrest the Matter in its Course outwards long enough, or in Quantity enough, to create those ulcerous Pustules, which are the Diagnostics of the Disease. For though the same feverish Disposition should arise again in the Blood, yet the Passages through the Skin being more open, the Matter will never be stopped, so as to exhibit the Appearance of the *Small Pox*. Accordingly we find, that in Persons severely handled with this Disease, the Face (which is ordinarily the foulest from the extraordinary Obstruction the Matter meets with by the great Constipation of the Pores) seldom returns to its former Dimensions; which Enlargement he accounts for from the Dilatation of those Glands and Pores of the Skin, not from any Augmentation of the Substance itself. He pretends, that what confirms this Hypothesis is, that Nurses, &c. who attend Persons sick of the *Small Pox*, are frequently a little affected with it, and have now and then two or three Eruptions; that they have no more, seems to follow from the free Course of the Matter through the Skin. That with this too agrees that constant Observation, that People of coarse Skins, in whom the Pores are largest, are always more favourably treated by this Distemper than others; and that it constantly leaves fine Skins coarser than it found them.

Some are of Opinion, that this Solution would seem more probable, were it not that some have so very few of those Eruptions, perhaps not above twenty or thirty, which cannot be fairly allowed so far to enlarge the Pores of the Skin as to prevent any Return.

Others hold, that in a genuine Eruption the Cause of the Distemper is so far evacuated, as scarce to leave a Possibility of a Return; and that if Part of the original Cause did remain behind, it might, when the Air favours it, or when by other Accidents it is secreted from the Blood, appear in the Form of Eruptions, and so prove to be the *Measles*, *Chicken-Pox*, &c. To which it may be objected, that these last mentioned often happen before the *Small Pox*; but it is answered, that whatever be the Cause of the *Small Pox*, the separating Power must be in such a determined Proportion, or it will fail to cause a regular *Small Pox*, and so acting proportionably, may produce any of the other Distempers just mentioned.

Note, also, That my own Sentiment on this Subject is, that as I really believe that the original Cause of the *Small Pox*, is an excessive Fermentation of the whole Mass of the Blood, whereby it endeavours to unburthen itself of all the Impurities the Child has contracted in the Womb, and brought along with him into the World, excited to it by the Intromission of

the Air necessary to accelerate its Circulation, which Air acts in a different Manner on the Humours which compose the Substance of the Blood, according to the different Qualities it acquires by the Changes of the Seasons, which are subject to as many Vicissitudes as all other sublunary Things: Therefore when the Air is impregnated with a greater Abundance of acid Particles in one Season than in another, meeting then with the alkine ones of the Blood, it consequently causes a greater Fermentation in the whole Mass, whereby all the Impurities it is charged withal, are impelled towards the Superficy of the whole Body, and crowding into the Pores force their Way through, till meeting with the outward Skin, which obstructs their Passage, they raise it up in Pustules, where by their continued Fermentation they extend still more and more, till the Points of their Ferment be blunted by the great Abundance of the viscous and tenacious Matter, whereby it is over-powered, they acquire a Sort of Rest, which we call *Maturation* of the Matter; and as the Blood has very seldom so much Impurities during the whole Course of our Life, as it has in the Beginning, being then loaded with those it has brought from the Womb, together with the other it has contracted since; that excessive Fermentation happens ordinarily at that Time, and when thereby it has been purged of all those Impurities, it is not surprising then if that extraordinary Phenomenon happens but once during the whole Course of one's Life; all the other Fermentations which happen afterwards being not attended with the same surprising Effects, since they serve only to purge the Blood of its own Impurities, which is done by means of the natural Evacuations; and if it happens that Persons die without having been ever afflicted with the *Small Pox*, it is because their Constitution was so strong as to force those Impurities to follow the Course of the common Evacuations; for the Blood must be totally purified soon or late of those Impurities it has extracted in the Matrice, one Way or other; which is the Reason why some have the *Small Pox* but when they are advanced in Years, which is occasioned both by the Weakness of their Constitution, incapable to force those Impurities to take another Course, and by the Quality of the Air mixed with the Blood.

There is also another cutaneous Disease frequent in Children, called in *England* the *Chicken Pox*, wherein the Skin is covered with Pustules like those of the *Small Pox* as to Figure and Magnitude; and only distinguishable therefrom in that those of the *Small Pox* appear with a Redness and Inflammation, and those of the *Chicken Pox* whiter, resembling Vesiculæ full of a scyrrhus Humour, which in three Days Time burst, and dry away without any Danger, and usually without any Fever.

The *Chicken Pox* and *Swine Pox*, seem to be the *Small Pox* in a less Degree, though they sometimes precede, and sometimes succeed the *Small Pox*. The Pustules appear to be of the same Kind; only in the *Swine Pox* they are much larger, and in the *Chicken Pox* sometimes less than in the *Small Pox*. There commonly appear five or six, sometimes twenty or thirty on the Face, and but very few on the Body.

The Patient is very little indisposed, either before, at, or after their Appearance, though the sudden sinking of them often causes some Disorder; but it is presently relieved by a little Sack and Saffron, or a Dose of Treacle-Water.

Grown Persons seldom keep within Doors for either; and upon that Account the Eruptions may continue the longer, because the cold Air is supposed to hinder their ripening, so that it is sometimes three Weeks or a Month before they totally disappear.

Dr. Freind, Dr. Cade, &c. recommend Purging and Bleeding, after an imperfect Crisis of the *Small Pox*, i. e. where the Fever remains after the Pustules decline; many oppose it. *Alfabaravius*, in the first Stage of the *Small Pox*, prescribes Bleeding even to a Swoon, and great Quantity of cold Water to be drank. In the malignant *Small Pox*, Dr. Jister found the Blood when

cold, excessively tender and friable, so as the softest Feather would easily divide its Globules. *Etemüller* says, there is nothing to be more regarded than the Breathing and Voice; where these are good it is an excellent Sign. He adds, that Horse-dung is an admirable Medicine, in that it promotes a Sweat, and saves the Throat.

Notwithstanding all these different Sentiments, mine is, that the Cure of the *Small Pox* depends chiefly on the Strength of Nature, who endeavours to expell those malignant Humours; therefore it must be help'd to conquer them as much as possible, and be strengthened, that it may succeed in the Task it undertakes; taking a particular Care not to divert it from its Operation, by any bleeding out of Season, or any other Remedy improperly applied.

The Patient must observe a good Regimen, abstaining from solid Aliments, and using none but liquid ones, such as Broth made of Veal and Chicken, Jelly, &c. his Drink should be a Pifane made of *French Barley* and Raisins; if he be at the Breast, he must eat no Pap during the whole Time, nor be carried in the Air, but he must be kept in a close Room, neither too hot nor too cold; for a too great Heat weakens the Child extremely, by making a too great Resolution and Dissipation of the Spirits; and the cold Air pushes back the Humours into the Body, and hinders the *Pox* from coming out. He ought to sleep moderately, that thereby the Humours being better concocted and digested, the coming out of the Pustules may be facilitated: his Body should be kept moderately open, by gentle Glysters for the Evacuation of the Excrements, in case they were detained too long in the Intestines.

But when the *Small Pox* is accompanied at the Beginning with a great Fever, a Difficulty of Breathing, and other Accidents, the principal Remedy is Bleeding, tho' several, who know nothing of the Matter, will not suffer it, imagining falsely that it hinders the *Pox* from coming out; and when Children who have been let Blood happen to die, though it be through the malignity of the Distemper, they attribute the Cause thereof to Bleeding; but it is certain, that it is the best Remedy in the first Days of that Malady, for thereby all the Humours are cooled, and the Plenitude thereof being evacuated, Nature governs, and conquers better what remains. As to Purgatives, they are not to be used at the Beginning, for Fear, that by putting the Humours in too great a Ferment, Nature should be disturbed in its Separation: But they must be administered towards the End, to evacuate what may be left of Impurities.

During the whole Time, the Patient must be given all that is capable to rejoice his Heart, strengthen his Stomach, and resist to the Putrefaction of the Humours, viz. Orange Juice, Syrups of Lemons and Pomegranates, mixed with his Dyet-drink, or a little Wine and Water, which is the best of all Cardiacks, if there is no great Fever; but if he be a Child at the Breast, Milk alone must suffice him for all.

As to what relates to Remedies applied outwards, that the Pustules may ripen with more Facility, as soon as they begin to appear, they should be all anointed, and particularly those of the Face, with Oil of Sweet Almonds, with a Feather dipped in it; some mix Cream with it, and others use only Fresh Butter. And when the Pustules are very ripe, which is known by their Whiteness, and the Itching, which ordinarily happens about the ninth Day, the biggest may be pierced to evacuate the Matter, lest by its sojourning too long it should ulcerate and corrodate too deeply the Parts; this must be done with a Gold or Silver Needle, or in cutting them with the End of Scissars; anointing the Face afterwards to dry them, with a Liniment made of Cream mixed with Chalk, continuing this Remedy till the Scabs be all fallen, and renewing it every Day, Morning and Evening.

To hinder the *Small Pox* from causing a too great Fluxion on the Eye, it is proper to use at first some cooling Remedy, as of Rose and Plantain-Waters mixed together, wherewith the Eyes are bathed from Time to Time. The Milk of the Nurse is also very good to appease the Pain of the Eyes; Care must be taken likewise from Time to Time, to unstop the Nose of the Child with small Tents, and to soften his Throat,

which is always worfe, he may drink some Syrup of Violets mixed with his Dyet-drink, which I know by Experience to be of great Use in that Cafe; helping the Expectoration of the Phlegms which stick to it, by means of that of Lemon or of Pomegranate; but Milk alone fuffices for a Child that fucks.

Note, That the most innocent Remedies, when the *Small Pox* is favourable, are best in that Malady; for in that Cafe I am contented to prescribe a good Regimen, without any of those Compositions, Powders, or other Repopees, which are of no other Use than to render the Symptoms worfe, and expose the Patient to several Accidents, which otherwise he had avoided.

Note, also, That of late Years a Practice has prevailed here in *England* (which in the *Roman Catholick* Countries is condemned as a criminal Presumption, and injurious to the Divine Providence) of inoculating, or ingrafting the *Small Pox*; which is performed in the following Manner.—After the Body is disposed and prepared with proper Dyets and Evacuations, two small Incisions are made, one in the muscular Part of the Arm, about the Place where an Issue is usually cut, and the other in the Leg of the opposite Side; then being provided with a small Quantity, as a Drop or less of well concocted variolous Matter, chosen from the distinct or best Sort of Pustules, before the Turn of the Distemper, and imbibed by two small Dossils of Lint; these are immediately put into the Incisions whilst the Matter remains warm, and are kept on by a proper Bandage: In a Day or two the Bandages are open'd and the Lint thrown away, and only Colewort-Leaf applied over the Incisions; this Dressing is continued daily. The Incisions usually grow sore, inflame, and enlarge of themselves, and discharge Matter more plentifully as the Distemper rises. The Eruptions generally appear within eight or ten-Days after the Operation; during which Time the Patient is not confined, or obliged to observe a very strict Regimen. Those who approve this Practice pretend that it is very beneficial, because the most proper Age, the most favourable Season of the Year, most regular Method of Preparation, and all possible Precautions may here be used according to the Wishes of the Patient, his Parents, and Physician; Advantages impossible to be had, say they, when the Distemper is caught in the natural Way. They pretend further, that it has been almost constantly observed, that the best Sort of *Small Pox* is hereby occasioned; that the Eruptions are few, the Symptoms light, the Danger next to none, the Recovery easy, and that the Patient is equally secured from this Distemper for the future, as he would be by having gone through it in the natural Manner; which is not my Sentiment, for though the *Inoculation of the Small Pox* seems entirely agreeable to my System of the original Cause thereof (*viz.* a general and excessive Fermentation of the Humours of the Body, which ordinarily happens once, since that variolous Matter introduced into the Body by means of the Incisions, may be considered as a Leaven which excites that Fermentation) it is notwithstanding a Sort of Presumption to violate Nature in its Operations, by putting the Humours into a Ferment, when it is not yet disposed to it, and consequently put the Life of the Patient in the most imminent Danger, at a Time which the divine Providence seemed not to have yet appointed for it. That Leaven besides, thus introduced, though it was of a laudable Consistence in the Body where it was naturally produced, may change Qualities in another where it is artificially introduced, and produce a quite different Effect, either by reason of the different Constitution, or because the Humours are otherwise disposed; as all Stomachs do not digest equally well the best Aliments, whatever Precautions may be used to dispose the Tone thereof towards it; therefore it is not surprising if for one Child who recovers by this criminal Practice, ten at least are killed; which is perhaps the Reason that we have not heard of late so much of inoculating for the *Small Pox*, as we did formerly. The *Sorbonne* at *Paris* has fulmi-

nated this Practice as criminal, which is perhaps one of the principal Reasons it has been so much in Vogue here.

If the *Small Pox* be a contagious Malady, it is not ordinarily so, but with regard to Children, for it seldom happens to Adults by Frequentation; but it is not so of the *Grand Pox*, whose Venom is so contagious and catching, that one Child infected with it, is capable to communicate it to whole Generations, both old and young.

Those who have that Distemper so young, have either brought it into the World along with them, having contracted it in the Womb of their Mother; which is discovered by their being born with Pustules and Ulcers in several Parts of their Body, and particularly on their Belly, towards the Fundament, and Inside of the Thighs, and likewise on the Head; or have contracted it since, by taking it from their Nurse; for then the first Impressions will appear towards the Mouth of the Child, where Ulcers will grow, because of the Acrimony of the bad Milk he sucks, which being his common Food, will infallibly communicate that Venom to all the Parts of his Body.—It must be observed, notwithstanding, that several Children who suck a Nurse much overheated, are seen, for that Cause alone, to have several Pustules on their Buttocks, and Inside of their Thighs, which renders the Nurse suspected of having the venereal Disease; but it may be easily judged that those Pustules, though large and risen, are simple, and without Malignity, if they be not accompanied with any other Accident; in which Case, those Pustules are cured by only giving the Child to a wholsomer Nurse.

It is very difficult to cure a Child born with the venereal Disease; and they almost always die some time afterwards; because their whole Substance cannot be restored, having had for Foundation so bad a Principle as the Blood of their Mother infected with such a Venom, of which they have been conceived, formed, and fed; but with regard to those who have taken it from their Nurse only, they are not incurable; because the Venom of the bad Milk, being not introduced presently with the whole Substance of the Milk into the Vessels of the Body of the Child, does not cause so great Ravages there, in this, as in the other Case; for it is then but the purest of that pocky Milk, or, to speak better, the less impure, which having been changed into Chyle in the Stomach, and purged through the Intestines of the greatest Part of its Excrements, can, by mixing with the Blood, alterate and corrupt it, by the bad Quality it retains still, notwithstanding the different Preparations it has received. But, however, the Child who has taken the Distemper from his Nurse, will never be cured while he sucks her, because her Milk is always infected with that Venom; and the worst is that in giving him another, (as it must be done to cure him) it is a great Hazard if he does not communicate to her that contagious Malady.

It may be said, in general, that the Cure of the venereal Disease is very difficult in all Children at the Breast; because through the Weakness of their Age they cannot take, then, nor bear, without great Danger of their Life, the necessary Remedies; therefore it could be wished that by a palliative Cure, the true one could be deferred till they be three or four Years old; but as several of those in that deplorable Condition perish before they be only a Year old, because that cruel Distemper goes always increasing, and the Accidents thereof make a greater Impression on their Body, because of the Tenderness and Delicacy thereof, than on that of those more advanced in Years, one's obliged, notwithstanding, at that Time, to undertake the Cure thereof, though the Child be still at the Breast: Which though a very dangerous Undertaking, a Surgeon is obliged to determine himself to it, when there is no Appearance to save the Child otherwise: Therefore he must proceed in the following Manner.

The first Thing to be done is to change the Nurse, when infected with the same Venom, to give him a very wholsome one; and for fear she should contract the same Distemper, she must wash her Nipple, after the Child has sucked, with Wine; and be purged, from Time

Time to Time, to keep her Body clean, and less susceptible of the Infection.

But often those Children thus afflicted, are so unhappy, that few Nurses will expose themselves, by giving them the Breast, to the Danger of catching that Distemper; in which Case one should be chosen with so great Abundance of Milk, as to be easily squirted into the Mouth of the Child; or having milked it into a Glass, to give it him afterwards, either in a Boat, Spoon, &c. but the surest Means is to make him suck a young Goat.

As for the Child, it is certain, that he'll never be cured of a confirmed Pox, but by the Use of Remedies, in the Composition thereof Mercury enters. Therefore after he has been let Blood, and purged with Syrup of Roses, or Chicory, his Pustules and Ulcers only, must be slightly anointed (if his Strength will allow it) with Unguentum of Mercury, and this Unction being reiterated by Degrees, a Salivation will be provoked, which ought to be almost insensible, for fear the Humours being thrown into a too great Motion, and carried with too much Impetuosity towards the Mouth, should make it swell to Excess, and cause in it malignant Ulcers, which would hinder him from sucking. Therefore the Unguentum should be but slightly charged with Mercury; for the Cure ought not to be precipitated. Which to do, after a slight Friction or two to the utmost, the Surgeon must abstain from it for five or six Days, to discover to what Degree the Child is moved thereby; and then, by the Effects of the first, one may easily judge if it be necessary to reiterate them, and in what Dose, which cannot be easily described; because there is as much Difference in Children's Constitutions, as in those of Men.

One may, likewise, instead of Frictions, or with them, wrap the Child in Blankets, perfumed slightly with Mercury, and even give him some Grains of *Mercurius Dulcis*, mixed with his Pap; and as to the Ulcers of his Mouth, the Nurse must wash them with Barley-Water, and Agrimony, mixing with it a little Honey of Roses, or Syrup of Wormwood, with white Wine, cleansing often therewith the Spittle which gathers in it. To evacuate it with more Facility, he must lie on his Side, and not on his Back, for fear that slimy Matter falling on his Lungs, or in the Stomach, should suffocate him. He must be kept very warm, and not be carried in the Air, watching carefully the Effect of the Remedy, which must be left to the Direction of an experienced Surgeon.

The common Manner of making the Unguentum, is to take half an Ounce of Mercury, which ought to be cleansed well of its Dirt, by making it run several Times through a Piece of Shamoy, after which it must be stirred in a Mortar, with four Ounces of Axonge of Pork, so much, and so long, that it may be well incorporated. Two Drachms of that Axonge must be taken for each Friction; and more or less according as the Child appears strong, and disposed to be moved.

As to the Manner to hinder Children being squint-ey'd, awry, crooked, and lame. The Body of young Children, by Reason of its Tenderness, is like soft Wax, or a young Tree, to which one may easily give what Figure one pleases at first; therefore particular Care must be taken, at that Time, that the good Conformation of their Members be not vitiated, through Negligence; or when even it is vitiated, it may be reduced into its natural State, through a necessary Care.

Therefore to hinder the Child from being squint-ey'd, he must have a Nurse which has no Irregularities or Disorders in her Eyes, lest if she had any, he should, by being obliged to look continually at her, follow her Example. His Cradle also should be always situated in such a Manner (as we have already observed elsewhere) that while he lies, he may see directly the Light; for fear that if he was side-wise, he should turn continually his Eyes towards the Place, whereby he would be in great Danger of becoming squint-ey'd.

Note, That Paul Eginette and Paré pretend, that the Sight of a squint-ey'd Child can be rectified, by putting a Mask on his Face, with only two small Holes, straight against his Eyes, through which he may see; whereby perceiving no other Light but through those Holes, he'll be obliged to keep his

Eyes fixed towards that Place, whereby they'll be strengthen'd in a direct Situation, and leave off, by Degrees, the bad Habit they had contracted of looking side-wise. This Advice seems good in Appearance, but several are of Opinion, that the Use of that Mask would be troublesome to the Child.

To hinder a Child from growing awry, crooked, or lame, the Child must be swathed very straight, his Arms, and Legs equally extended, rolling him sometimes on one Side, and sometimes on the other; for fear that by rolling him always in the same Manner, his Parts should take a bad Form. He must be laid in his Cradle directly on his Back, without being bent, but be supported every where; and when his Nurse holds him in her Arms, she must carry him some time in one, and some time in the other; for in pressing his Legs against her always on the same Side, she would run the Risk of bending them.

When those Parts shall have some bad Conformation, they must be mended with Bands and Compresses, applied on the Places where they are wanted, to keep them in a right State, while the Child is in his Swaddling-Cloaths: But I condemn much the Practice of making him wear small Boots when he is bigger; for I have seen Children, whose Legs had certainly grown very straight with Age, and in Proportion as their Strength had increased, have them monstrously deform'd, by having wore those Sorts of Boots.

When the Breast, or the Back-bone are deform'd, that Vice must be remedied, if possible, or at least, hinder'd from increasing, or the Imperfection hid by padding the Cloaths of the Child, in the Places where the Surgeon shall judge proper, to rectify the ill conformed Parts, and give them a better Figure.

Note, That so far I have treated of the most common Maladies incident to Children; and that it is not necessary to make in this Place a more ample Description thereof; and for the others I have not mention'd as they happen to young and old indifferently; they have nothing particular with Regard to Children, either for their Knowledge, or their Cure, unless it be by Reason of the Tenderness, and Delicacy of their Body; therefore I'll terminate this Treatise by discovering the Qualities necessary in the Choice of a good Nurse.

The *Qualities necessary to a good Nurse*, are ordinarily taken from her Age, from the Time and Manner she was deliver'd, from the Constitution of all the Parts of her Body, and particularly of her Breasts, from the Nature of her Milk, and lastly from her good Conduct.

As to her Age, the most convenient is from twenty-five to thirty-five; because during that Space of Time, a Woman is more wholesome, strong, and vigorous: She is not so proper under twenty-five, because her Body having not yet acquired then all its Dimensions, cannot be so robust; and above thirty-five, having not so great Abundance of Blood, she has not Milk enough to feed the Child; tho' some Women are pretty good Nurses at twenty, and others as far as forty, but very seldom above and under those Ages.

For the Time and Manner in which she is deliver'd, some are of Opinion, that she must have been deliver'd five or six Weeks before she suckles a Child, that her Milk may be entirely purified; because then her Body is purged of all the Impurities which follow the Delivery; but there should not be more than three or four Months, that one may not be obliged to give him another; neither is it to be after an Abortion, but she must have been deliver'd at Term; and some will have it, that it should be of a strong healthy Boy; which is a Sign of a good Constitution; who should be her second or third Child, that she may be well skill'd in the Manner of governing her Child. But in my Opinion, a new Milk of twelve or fifteen Days is preferable to any other.

But a good Constitution is the principal Quality of a Nurse, and on which all the others depend. Therefore she must be very healthy, without being subject to any Malady; born of Parents who were not subject to the Stone or Gravel, nor to the King's Evil, Epilepsy, or some other hereditary Malady; she should not have the

least

least Spot on her Body, nor even be suspected of the Venereal Disease; without Scab, Itch, or any other Imperfection of that Nature: She must be robust, and of a moderate Height, neither too little, nor too tall, too fat, nor too lean; of a sanguine Complexion; and not subject to have her Menfes while she suckles, which would be a Sign that her Blood is over-heated; nor to the Whites, because those Superfluities are an Indication of a bad Constitution. She ought not to be red-hair'd, nor freckled; but she should be black or brown; she should be well shaped, clean in her Cloaths, and handsome, having a brisk Eye, and straight Sight, wholesome and white Teeth, without any of them rotten, for fear her Mouth should have a bad Smell, for as she kisses often her Child, she would infect his Lungs, by making him breathe her stinking and corrupt Breath. Her Breasts must be ample enough to contain a sufficient Quantity of Milk, but not large to Excess; whole, and without Cicatrices, proceeding from Imposthumes; moderately firm and fleshy, not flabby, nor hanging down; that the natural Heat may be stronger. The Chest of a Nurse must be large, that the Milk may have more Space, to be well prepar'd and digested, and because a broad Chest, denotes Abundance of natural Warmth. As to the Nipples, they must be well shaped, neither too big, nor too hard, nor callous, nor too deep in the Breast; but they should be a little risen of a moderate Bigness, perforated of several little Holes, that the Child may not have much Trouble in sucking.

If a Nurse has all the good Qualities above-mention'd, in what regards the Parts of her Body, one may very well judge that her Milk is very well condition'd; which will be known first at its Quantity, which must be such, that it may suffice to feed the Child; but it should not be in too great Abundance, for fear the Child being not capable to suck it all, it should grow knotted, and corrupted in the Breast, by sojourning too long in them; though it is much better she should have more than less; for she may very well make another Child suck the Surplus. That Milk must be of a moderate Substance and Consistence, *i. e.* neither too watery, nor too thick; which may be easily known, if the Nurse having milked some Drops of it on the Hand, in inclining it a little, it presently runs, which is a Sign that it is too watery, and not enough concocted; if, on the contrary, the Drops remain fast on the Hand, without running, when it is inclin'd, that Milk is too coarse and viscous. The best is that which is between the two Consistences, which runs softly in Proportion as the Hand is inclined, leaving the Place whence it runs a little tinged. As to its Colour, the whitest is the best, and the more it deviates from that Colour, the worse it is; it must be of a sweet and agreeable Smell; the contrary is known

in red-hair'd Women, whose Milk is of a sourish, stinking, and bad Smell; and to be perfect in all the good Qualities, it must be well tasted, *i. e.* sweet, without any Acrimony, or strange Taste, and not too hot.

We must not forget the principal and best Qualities of a Nurse, which consist in her good Conduct, therefore she should be vigilant, and careful in cleaning her Child so soon as he wants it; wise, prudent, and not subject to Passion, or quarrelsome, either for fear of giving in those Beginnings, bad Impressions to her Child, or because that Passion over-heats extremely the Milk. She should not be melancholy, but chearful and gay, laughing often and moderately; she must be very sober, not at all addicted to Wine, much less to spirituous Liquors, nor to Coition; though she should not abstain quite from the last, if her Constitution requires it; provided she uses it with Moderation: This Liberty is founded on Experience, for we see daily a great Number of Women, especially of the poorest Sort, who though they be every Night with their Husbands, and in all Appearance are cared for by them, rear up very well their Children; for the Seed kept too long in the Vessels (particularly in Women accustomed to use often Coition) being over-heated too much for Want of Evacuation, causes such an Itching in those Women, who are forced, in Spite of themselves, to abstain from it, that it is soon corrupted; after which it causes a great Agitation, as well of the Humours of the Body, as of the Passions of the Soul. Therefore there is no Danger if the Nurse uses moderately Coition, only to evacuate the too great Plenitude; abstaining only from giving the Breast to her Child soon after it, but must wait at least one or two Hours.

Note, That the principal Quality of a good Nurse, is to be the own Mother of the Child she suckles; as well by Reason of the Report of the Constitution of one to the other, as because a Mother having much more Love for him, she is more careful than a hired Nurse, in whose Love there is very little Sincerity, and has no other End but the Reward she expects for her Trouble; therefore an own Mother, though perhaps not quite so good, is always to be preferred to a strange Nurse: For can those be justly called Mothers, who against the Laws of Nature, throw off from them their Child, so soon as he is born, and deny him the Milk of their Breast, while they see him imploring with Tears the Succours thereof? Brutes, and even the wildest among them, would be moved at such a Spectacle, which is not capable to make the least Impression on a barbarous Woman, though at the same Time she has the Impudence to call herself Mother.

M I N E R A L S.

MINERALS are compound Fossils, wherein there is something discover'd in all Respects like Metal, only that it is not malleable; joined or compounded with some other Fossil, as Salt, Sulphur, Stone, or Earth.

Those Minerals are *Antimony, Cinnabar, Bismuth, Calaminaris, Vitriol, Pyrites, Marcasites, Cobalt, Oker, the Magnet, Lapis Hematites, Armenus, and Stel-latus.*

I consider most of the Minerals as imperfect Metals, the Imperfection whereof proceeds either from the bad Disposition of the Subject, worked upon; or from the unconquerable Obstacles the Agents have met with in their Operation, or from their Imbecility; or from the Excess of their Power. The Badness of the Subject is occasioned, either from the vitiated Conformation of the Matrice, where it is elaborated; or from the too great Abundance of the heterogeneous Particles it is enveloped with, and from which it cannot be separated perfectly enough to form a Compound capable to answer the Intentions of Nature.

The Agents are interrupted in their Operation, either by the Interposition of impervadable Bodies, or the too great Obliquity of the Meatus through which they must reach the Subject they are to operate upon; and which causes that their Power is more than half exhausted, before it arrives at the Place where it is to operate; whence its Efforts being too weak, the metalline Particles, though excited to Motion, and disposed in order for a close Union between them, are still kept at a too great Distance by the Interposition of the heterogeneous ones they are mixed with, in lieu of which a loose and deformed Texture ensues, composed of Particles almost all heterogeneous to each other, and almost all of a different Direction, we call *Mineral*.

Sometimes also, the Imbecility of the Agent, or the too great Excess of its Power, proceeds from the Climate; where the Agent is either at too great a Distance from the Subject it is to work upon, or too near it; if it be at too great a Distance from it, the Separation of the metalline Particles is imperfect, as well as their Union; and if it be too near it, that Separation is

is made with so much Precipitation, that the Particles, by a too violent Agitation and Friction, as well against heterogeneous Bodies, as against one another, are half wore out, before their Union can be effected; so though they are not mixed with Abundance of heterogeneous Particles, their Texture is notwithstanding loose, because deprived of the Parts most proper for a close Cohesion. Hence the Difference found in Minerals; some of them being more compact than the others; of which we shall be better persuaded, by the following Examen of each Mineral, in particular, beginning by *Antimony*.

ANTIMONY, is what we properly call a *Semi-Metal*; being a fossil Glebe, composed of some undetermined Metal, combined with a sulphurous and stony Substance.

I say that *Antimony* is composed of some undetermined Metal, for in Reality it has nothing but the Appearance of a Metal; for its most subtile Particles, which if exhaled by a powerful Agent, could perhaps receive a Direction to a more intimate Union between themselves, so as to form a Metal (though it does not appear by the Analysis made of *Antimony*, what Sort of Metal it would be, since it has no Report to any of the known Metals) are buried under so great a Heap of undigested Sulphur and Earth, that Art itself has not yet discover'd the Secret, notwithstanding the different Sorts of Operations it has invented for that Purpose, to make a Separation thereof, perfect enough, to form a compact Compositum; since after all those Operations which give *Antimony* so many different Forms, that it seems a *Proteus*, there remains yet so great a Quantity of Sulphur, that it cannot form a compact Compositum, so as to deserve the Name of Metal, or rather it is nothing else but a Texture of sulphurous Particles loosely joined together, by a few saline ones: So that I consider it as the Dross or Scoria of other Metals, separated from them in their Preparation in the Matrice.

Antimony is found in Mines of all Metals, but chiefly those of Silver and Lead: That in Gold Mines is usually held the best, which confirms my Opinion of its being the Dross of Metals; since Gold being the most perfect of all Metals, the Dross separated from it in its Matrice, must also be the less impure. — It has also its own Mines, particularly in *Hungary*, *Transylvania*, and *Germany*, and in several Provinces of *France*. That of *Hungary* is the best, being full of long Needles.

Antimony is found in Clods or Stones of several Sizes, bearing a near Resemblance to Black Lead, only that it is lighter and harder; whence also it is called *Marcasite of Lead*, but very improperly, and its metalline Parts supposed to be of that Species: Its Texture is somewhat particular, being full of little shining Veins or Threads like Needles, brittle as Glass. Sometimes there are Veins of a red or golden Colour intermixed, which is called *Male Antimony*, that without them being denominated *Female*. It fuses in the Fire, though with some Difficulty, and dissolves more easily in Water.

When dug out of the Earth it is put into large Crucibles, fused by a violent Fire, and then poured into Cones, or antimonial Horns, which make the common or crude *Antimony* of the Shops, the Apex whereof is always the best and purest Part, as the Basis or broadest Part is the foulest.

Antimony is supposed by many of the Chymists to contain the seminal Principles of all kind of Bodies; and accordingly the Character whereby it is denoted in their Writings, is the same with the Character of the Earth; to denote that *Antimony* is a Kind of Microcosm.

The Uses of *Antimony* are very numerous and important. — It is a common Ingredient in Specula, or burning Concaves, serving to give them a finer Polish. It makes a Part in Bell-Metal, and renders the Sound more clear. It is mingled with Tin to make it more hard, white and sounding, and with Lead in the casting of Printers Letters, to render them more smooth and firm. It is a general Help in the melting of Metals, and especially in the casting of Cannon Balls.

As I have described in my Treatise of Chymistry, the different Preparations of *Antimony*, and its different Uses in Pharmacy, it would be needless to repeat them in this Place: Therefore,

CINNABAR, is a mineral Stone, red, heavy, and

brilliant, found chiefly in the Quicksilver Mines.

Some have imagined *Cinnabar* to be Dragon's-Blood, gathered, as *Pliny* and *Solinus* have it, when the Dragon and Elephant fight together: This Fable is refuted by *Dioscorides* and *Scaliger*.

Cinnabar is either *native* or *fañitious*.

Native, or *mineral Cinnabar*, which is that above-mentioned, is found in most Places where there are Quicksilver Mines; yet it is true also, that it has Mines of its own: Those in *Spain* are very famous; the *French* have theirs in *Normandy*.

It may be esteemed as *Marcasite* of Quicksilver, or rather as Quicksilver petrified and fixed, by means of Sulphur, and a subterraneous Heat; for the globulous Particles of Quicksilver being put into a natural Motion, by the subterraneous Heat roll themselves in the Sulphur, already softened by the same Heat, wherein being wrapped, at last their whole Motion is intercepted; and the whole Composition being hardened afterwards by the same graduate Heat, becomes that red, heavy, and brilliant Stone, we call *native Cinnabar*.

Each Pound of good *Cinnabar* yields fourteen Ounces of good Mercury; accordingly, the principal Property and Use of this Mineral is to yield a most excellent Mercury; and that which the Alchymists maintain to be the best disposed for attaining to the Transmutation of Gold.

The best *mineral Cinnabar* is of a high Colour, brilliant, and free from the Stone. It is used by Physicians in venereal Cases, and others occasioned by sharp Serofities: It is also esteemed a good Cephalick, accounted of Service in Epilepsies, and other nervous Distempers; Add, that it is reckoned of Efficacy in cutaneous Cases, as the Scurvy.

Fañitious, or *artificial Cinnabar*, is formed of a Mixture of Mercury and Sulphur sublimed, and thus reduced into a kind of fine red Glebe. The best is of a high Colour, full of Fibres like Needles.

The *fañitious Cinnabar* is prepared, by melting one Part of Sulphur in a Pipkin; then putting to it by a little at a Time, three Parts of Quicksilver, stirring them together till no Mercury appears; then letting them cool, they grind the Mixture, put it in a Bolt-head, bake it, and place it over a naked Fire, which they augment by Degrees, a coloured Fume arises first to the Top of the subliming Vessel, which in the further Progress of the Heat, becomes at length of a red Crimson Blue; taking it off the Fire, the *Cinnabar* is found above the Faeces.

This serves for the same medicinal Purposes with the *native Cinnabar*; besides which, it is likewise used by the Farriers, to make Pills for their Horses, and by Painters as a Colour; as being a very vivid Red, but drying with some Difficulty, and not comparable to the *Carmin*; which I have the Secret to make, and no Body else in *England*.

The *Cinnabar*, called also by the Painters *Vermillion*, is rendered more beautiful by grinding it with Gum-Water, and a little Saffron, those two Drugs preventing its growing black.

There is likewise a blue *Cinnabar*, made by mixing two Parts of Sulphur with three of Quicksilver, and one of Sal Ammoniack; those being sublimed produce a beautiful blue Substance, whereas Quicksilver and Sulphur alone produce a Red; but this Blue falls very short of the *Ultramarine*, of which I have also the Secret.

BISMUTH, is a mineral Body, half metallick, composed of the first Matter of Tin, while yet imperfect; and found usually in Tin-Mines, sometimes also in Silver Mines.

Its Substance is hard, ponderous, and brittle, of a large Grain, glossy, white, and shining. It is also called *Tin-Glass*, because when broke it shews a vast Number of little polished Laminæ like Glass: It is also called *Marcasite*, by way of Excellence, because surpassing all others in Whiteness and Beauty.

Bismuth contains an arsenical Salt, very dangerous to take inwardly. It is this arsenical Salt which coroding its Texture, renders it so brittle, and hinders that intimate Cohesion of its constituent Parts, which otherwise would render it a perfect Metal, since it has less Impurities than Tin itself.

least Spot on her Body, nor even be suspected of the Venereal Disease; without Scab, Itch, or any other Imperfection of that Nature: She must be robust, and of a moderate Height, neither too little, nor too tall, too fat, nor too lean; of a sanguine Complexion; and not subject to have her Menfes while she suckles, which would be a Sign that her Blood is over-heated; nor to the Whites, because those Superfluities are an Indication of a bad Constitution. She ought not to be red-hair'd, nor freckled; but she should be black or brown; she should be well shaped, clean in her Cloaths, and handsome, having a brisk Eye, and straight Sight, wholesome and white Teeth, without any of them rotten, for fear her Mouth should have a bad Smell, for as she kisses often her Child, she would infect his Lungs, by making him breathe her stinking and corrupt Breath. Her Breasts must be ample enough to contain a sufficient Quantity of Milk, but not large to Excess; whole, and without Cicatrices, proceeding from Imposthumes; moderately firm and fleshy, not flabby, nor hanging down; that the natural Heat may be stronger. The Chest of a Nurse must be large, that the Milk may have more Space, to be well prepar'd and digested, and because a broad Chest, denotes Abundance of natural Warmth. As to the Nipples, they must be well shaped, neither too big, nor too hard, nor callous, nor too deep in the Breast; but they should be a little risen of a moderate Bigness, perforated of several little Holes, that the Child may not have much Trouble in sucking.

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ANTIMONY, is what we properly call a *Semi-Metal*; being a fossil Glebe, composed of some undetermined Metal, combined with a sulphurous and stony Substance.

I say that *Antimony* is composed of some undetermined Metal, for in Reality it has nothing but the Appearance of a Metal; for its most subtile Particles, which if exhaled by a powerful Agent, could perhaps receive a Direction to a more intimate Union between themselves, so as to form a Metal (though it does not appear by the Analysis made of *Antimony*, what Sort of Metal it would be, since it has no Report to any of the known Metals) are buried under so great a Heap of undigested Sulphur and Earth, that Art itself has not yet discover'd the Secret, notwithstanding the different Sorts of Operations it has invented for that Purpose, to make a Separation thereof, perfect enough, to form a compact Compositum; since after all those Operations which give *Antimony* so many different Forms, that it seems a *Proteus*, there remains yet so great a Quantity of Sulphur, that it cannot form a compact Compositum, so as to deserve the Name of Metal, or rather it is nothing else but a Texture of sulphurous Particles loosely joined together, by a few saline ones: So that I consider it as the Dross or Scoria of other Metals, separated from them in their Preparation in the Matrice.

Antimony is found in Mines of all Metals, but chiefly those of Silver and Lead: That in Gold Mines is usually held the best, which confirms my Opinion of its being the Dross of Metals; since Gold being the most perfect of all Metals, the Dross separated from it in its Matrice, must also be the less impure. — It has also its own Mines, particularly in *Hungary*, *Transylvania*, and *Germany*, and in several Provinces of *France*. That of *Hungary* is the best, being full of long Needles.

Antimony is found in Clods or Stones of several Sizes, bearing a near Resemblance to Black Lead, only that it is lighter and harder; whence also it is called *Marcasite of Lead*, but very improperly, and its metalline Parts supposed to be of that Species: Its Texture is somewhat particular, being full of little shining Veins or Threads like Needles, brittle as Glass. Sometimes there are Veins of a red or golden Colour intermixed, which is called *Male Antimony*, that without them being denominated *Female*. It fuses in the Fire, though with some Difficulty, and dissolves more easily in Water.

When dug out of the Earth it is put into large Crucibles, fused by a violent Fire, and then poured into Cones, or antimonial Horns, which make the common or crude *Antimony* of the Shops, the Apex whereof is always the best and purest Part, as the Basis or broadest Part is the foulest.

Antimony is supposed by many of the Chymists to contain the seminal Principles of all kind of Bodies; and accordingly the Character whereby it is denoted in their Writings, is the same with the Character of the Earth; to denote that *Antimony* is a Kind of Microcosm.

The Uses of *Antimony* are very numerous and important. — It is a common Ingredient in Specula, or burning Concaves, serving to give them a finer Polish. It makes a Part in Bell-Metal, and renders the Sound more clear. It is mingled with Tin to make it more hard, white and sounding, and with Lead in the casting of Printers Letters, to render them more smooth and firm. It is a general Help in the melting of Metals, and especially in the casting of Cannon Balls.

As I have described in my Treatise of Chymistry, the different Preparations of *Antimony*, and its different Uses in Pharmacy, it would be needless to repeat them in this Place: Therefore,

CINNABAR, is a mineral Stone, red, heavy, and

brilliant, found chiefly in the Quicksilver Mines.

Some have imagined *Cinnabar* to be Dragon's-Blood, gathered, as *Pliny* and *Solinus* have it, when the Dragon and Elephant fight together: This Fable is refuted by *Dioscorides* and *Scaliger*.

Cinnabar is either *native* or *fañitious*.

Native, or *mineral Cinnabar*, which is that above-mentioned, is found in most Places where there are Quicksilver Mines; yet it is true also, that it has Mines of its own: Those in *Spain* are very famous; the *French* have theirs in *Normandy*.

It may be esteemed as *Marcasite* of Quicksilver, or rather as Quicksilver petrified and fixed, by means of Sulphur, and a subterraneous Heat; for the globulous Particles of Quicksilver being put into a natural Motion, by the subterraneous Heat roll themselves in the Sulphur, already softened by the same Heat, wherein being wrapped, at last their whole Motion is intercepted; and the whole Composition being hardened afterwards by the same graduate Heat, becomes that red, heavy, and brilliant Stone, we call *native Cinnabar*.

Each Pound of good *Cinnabar* yields fourteen Ounces of good Mercury; accordingly, the principal Property and Use of this *Mineral* is to yield a most excellent Mercury; and that which the Alchymists maintain to be the best disposed for attaining to the Transmutation of Gold.

The best *mineral Cinnabar* is of a high Colour, brilliant, and free from the Stone. It is used by Physicians in venereal Cases, and others occasioned by sharp Serofities: It is also esteemed a good Cephalick, accounted of Service in Epilepsies, and other nervous Distempers; Add, that it is reckoned of Efficacy in cutaneous Cases, as the Scurvy.

Fañitious, or *artificial Cinnabar*, is formed of a Mixture of Mercury and Sulphur sublimed, and thus reduced into a kind of fine red Glebe. The best is of a high Colour, full of Fibres like Needles.

The *fañitious Cinnabar* is prepared, by melting one Part of Sulphur in a Pipkin; then putting to it by a little at a Time, three Parts of Quicksilver, stirring them together till no Mercury appears; then letting them cool, they grind the Mixture, put it in a Bolt-head, bake it, and place it over a naked Fire, which they augment by Degrees, a coloured Fume arises first to the Top of the subliming Vessel, which in the further Progress of the Heat, becomes at length of a red Crimson Blue; taking it off the Fire, the *Cinnabar* is found above the Fæces.

This serves for the same medicinal Purposes with the *native Cinnabar*; besides which, it is likewise used by the Farriers, to make Pills for their Horses, and by Painters as a Colour; as being a very vivid Red, but drying with some Difficulty, and not comparable to the *Carmin*; which I have the Secret to make, and no Body else in *England*.

The *Cinnabar*, called also by the Painters *Vermillion*, is rendered more beautiful by grinding it with Gum-Water, and a little Saffron, those two Drugs preventing its growing black.

There is likewise a blue *Cinnabar*, made by mixing two Parts of Sulphur with three of Quicksilver, and one of Sal Ammoniack; those being sublimed produce a beautiful blue Substance, whereas Quicksilver and Sulphur alone produce a Red; but this Blue falls very short of the *Ultramarine*, of which I have also the Secret.

BISMUTH, is a mineral Body, half metallick, composed of the first Matter of Tin, while yet imperfect; and found usually in Tin-Mines, sometimes also in Silver Mines.

Its Substance is hard, ponderous, and brittle, of a large Grain, glossy, white, and shining. It is also called *Tin-Glass*, because when broke it shews a vast Number of little polished Lamine like Glass: It is also called *Marcasite*, by way of Excellence, because surpassing all others in Whiteness and Beauty.

Bismuth contains an arsenical Salt, very dangerous to take inwardly. It is this arsenical Salt which coroding its Texture, renders it so brittle, and hinders that intimate Cohesion of its constituent Parts, which otherwise would render it a perfect Metal, since it has less Impurities than Tin itself.

There is an artificial *Bismuth*, which is that ordinarily found in the Shops, made by reducing Tin into thin Laminæ or Plates, and cementing them, by a Mixture of white Tartar, Saltpetre, and Arsenick, stratified in a Crucible over a naked Fire. The same is also made of a Mineral called Rink, using Lead instead of Tin, and a little Calamine.

Calamine Stone, or *Lapis Calaminaris*, is a Kind of fossil, bituminous Earth, of some Use in Medicine, but of more in Foundry; being used to dye Copper yellow, *i. e.* to convert it into Brass. It is either of a brownish Colour, as that of *Germany* and *England*; or reddish, as that about *Liege*, and in some Parts of *France*, accounted the best, because turning yellow by Calcination.

Calamine is dug out of Mines, usually in some Pieces, having always Eyes, sometimes Veins of Lead; though it be not always found in Lead-Mines. In *England* there are Mines of *Calamine*, at *Wrington* in *Somersetshire*, and elsewhere. It is generally dug in barren rocky Ground, its Courses running usually, at 6 o'Clock, as they call it, *i. e.* from East to West; sometimes at 9, and sometimes at 12; or perpendicular, which is accounted the best.

When dug it is washed, or buddled, as they call it, in running Water, which carries off the impure and earthy Parts, leaving the Lead, Calamine, and other sparry Parts at Bottom; they then put it in a Sieve, and shaking it well in Water, the Lead mixed with it sinks to the Bottom, the sparry Parts get to the Top, and the *Calamine* lies in the Middle: Thus prepared they bake it in an Oven four or five Hours, the Flame being so contrived as to pass over, and so to heat and bake the Calamine, stirring and turning it all the while with Iron Rakes: This done, they beat it to Powder and sift it, picking out of it what Stones they find; and thus it is fit for Use.

Besides the two natural *Calamines*, there are two artificial ones; the best is that called *Pampholyx*.

VITRIOL, is a mineral Substance, composed of an acid Salt, intermixed with something metalline.

It is defined by *Boerhaave* a saline, metallick, transparent Glebe, dissoluble in Water, and fusible and calcinable by Fire.

It acquires different Names, according to the different Places where it is dug, and the *Vitriols* of those also, differ from each other in Denomination and Colour, some being white, others blue, and others green.

Roman and *Cyprus* Vitriol, for Instance, is blue; and that of *Sweden* and *Germany* greenish; besides which there is also a white Kind.

White Vitriol partakes but little of any Metal; *blue* partakes of Copper, and *green* of Iron.

M. *Geoffroy* the Elder observes, that they all consist of an acid Salt, like that found in Allum and Sulphur, excepting that in Allum the Acid is mixed with an absorbent Earth or Calx; in Sulphur it is united with fat bituminous Parts, and in *Vitriols* with metallick Parts.

According to *Boerhaave*, *Vitriols* consist of a metallick Part, with a Sulphur adhering, a menstruous Acid, and Water. In *blue Vitriol*, the Metal wherewith the Acid, &c. is joined, is Copper. In *white Vitriol*, called also *white Copperas*, it is mixed with Lapis Calaminaris, or some ferruginous Earth, intermixed with Lead or Tin. In *green Vitriol* the Acid is joined with Iron.

The Antients give the Name *Chalcitis*, or *Chalcantum* to native *Vitriol*, or that which acquires its full Perfection in the Entrails of the Earth, and which is a Kind of mineral Stone of a reddish Colour. Of this they observe three different States or Transformations; *Chalcitis* in its first State they called *Misi*; this afterwards turned into *Melanteria*, and that into *Sori*.

Some Moderns take this *Chalcitis* to be the same with the Colchotar brought from *Sweden* and *Germany*, the best whereof is of a brownish red Colour, and a vitriolick Taste, and dissolves easily in Water; and when broke is of the Colour of shining Copper.

All the other *Vitriols* above-named are really factitious, being only a Kind of Crystals, drawn by means of Water, from a Sort of Marcasite ordinarily found in Mines, and called by Naturalists *Pyrites*, or *quis*.

Roman Vitriol, is made by exposing the *Pyrites* to the

Air, till such Time as they calcine, and change into a greenish, and vitriolick Calx or Dust; in which State they are thrown into the Water, and afterwards, by Boiling and Evaporation, reduced into that Kind of Crystals sent us from *Italy*.

All other *Vitriols* are made after the same Manner; that is much after the same Manner as Allum is made in *England*, or Saltpetre in *France*.

For green Vitriol, they add a great Number of Pieces of Iron to the Liquor in the Boiling; these raise a great Ebullition. As soon as the Iron is dissolved they evaporate the Dissolution to a certain Degree, and so let it crystalize. The Crystals being furnished, there remains a thick, reddish, unctuous Styptick and astringent Liquor, which M. *Geoffroy* calls *eau mere de vitriol*; as containing all the Principles of the *Vitriol*, tho' disunited.

The Powder of this *Vitriol* is exceedingly styptick, and excellent for the Cure of Wounds, and the stopping of Blood. Its Effects this Way have been raised by the Knavery of some, and Credulity of others, to a Kind of Miracle; it being this that makes the Basis of the famous sympatherick Powder.

The medicinal Virtues of *Vitriol* are very great, but allowed to the Iron, or other metallick Parts mixed with it, and therefore follow the Kind of Metal. Thus those of green *Vitriol* depend on the Styptick or Astringency of Iron or Mars.

The *Eau mere* drawn from green *Vitriol*, M. *Geoffroy* observes, does not differ any Way essentially, from a great Number of Preparations, which the Chymists have given us of Vitriol, Iron, and the Lapis hæmatites; as the fixed and anodyne Sulphurs of *Vitriol* or Mars, Arcana and Magisteries of *Vitriol*, Tinctures, &c. of *Vitriol*, Mars, &c. The common Basis of all which is Iron exceedingly subtilized and attenuated.

PYRITES, from the Greek πυρίτης, *q. d.* Firestone, is a sulphurous inflammable Kind of Mineral, composed of an acid Salt, incorporated with an oily or bituminous Matter.

Pyrites bears a near Affinity to *Marcasite*, with which the Generality of Authors confound it. Dr. *Woodward* makes this Distinction between the two, that *Pyrites* is restrained to the Nodules, or those Pieces found lodged in Strata of another Kind; and *Marcasite* to those found in Strata of the same Kind. Add that the *Marcasite* frequently contains Arsenick, which the *Pyrites* does rarely, if ever.

Pyrites has always a metalline Part in it, and sometimes a cretaceous or okerous Part. — In Proportion as any of these prevails, the Body commences a Sulphur, Allum, or Vitriol.

The Metal in *Pyrites* is chiefly Iron; sometimes there is Copper in it, and always a little Gold, rarely Silver, and never Lead or Tin.

Dr. *Stare* tells us of a Heap of *Pyrites*, consisting of two or three hundred Tuns, which being cover'd up from the Air five or six Months, took Fire, and burnt for a Week. Some of it look'd like melted Metal, others like red-hot Stones. He adds, it emitted a most noisome Smoke.

Dr. *Lifter* attributes Thunder, Earthquakes, &c. to the sulphurous and inflammable Breadth of the *Pyrites*.

MARCASITE, is a Sort of metallick Mineral, making as it were the Seed or first Matter of Metals.

On this Principle there should be as many different *Marcasites* as Metals; which is true in Effect; the Name being applied to every Mineral Body, that has metalline Particles in its Composition, though not enough to make it worth working, in which Case it would be called Ore.

There are only three Kinds in the Shops, *viz.* *Marcasite* of Gold, of Silver, of Copper; though some repute the Load-stone, *Marcasite* of Iron; *Bismuth*, *Marcasite* of Tin; and Rink or Spelter, *Marcasite* of Lead.

Marcasite of Gold, is in little Balls or Nodules, about the Bigness of Nuts, nearly round, heavy, of a brown Colour without. — *Marcasite* of Silver, is like that of Gold, only paler colour'd: Within, the Colour differs much, the one having a Gold Colour, and the other a Silver Colour, both shining and brilliant. — The *Marcasite* of Copper, is about the Bigness of a small Apple, round.

round or oblong, brown without, yellow and crystalline within, brilliant and shining.

Marcasites are found in Mines of Metals; they all contain Sulphur and a vitriolick Salt, especially that of Copper: Some of them also contain Antimony and Bismuth.

COBALT, is a Kind of *Marcasite*, supposed to be the *Cadmia* of the Antients, out of which is drawn Arsenick and Smalt.

Cobalt usually contains a little Silver, some Copper, but much Arsenick. There are various Mines of *Cobalt*, especially in *Saxony*, some in *France*, and *England*.

OKER, or **OCHER**, a yellow, dry, fossil Earth; harsh to the Touch; found in Copper and Lead Mines, sometimes in those of Silver, and sometimes in Mines of its own.

Others seem more rightly to refer *Oker* to the Class of Semi-Metals, than of Earths. It consists, according to them, of Earth and a Metal, particularly Iron, combined.

Mr. Boyle assures us, he has seen a Piece of *Oker*, richer in Metal than most Iron Ores; and which was even render'd magnetical by heating, and then cooling it in a perpendicular Position.

Oker, in Effect, is always impregnated with Iron, and is what generally gives to the Chalybeat Springs their medicinal Virtues; many of which we see upon the Waters standing, will deposite the *Oker* at the Bottom of the Vessel.

Some Authors esteem *Oker* proper to promote the melting of Metals, when they are too harsh and brittle; but its chief Use is in Painting.

It is only the yellow *Oker* is natural; the red is prepared from the yellow, by calcining it in the Fire, till it has acquir'd its Redness.

The Beds are usually from one hundred and fifty, to two hundred Foot deep; and their Thickness from four to eight Inches, between a white Sand which covers them at top, and a yellow argillous Earth underneath.

The best *Oker* is that of *Berry* in *France*. There are several Kinds dug up in *England*, all bordering on the red; some of them used in polishing Looking-Glasses.

LAPIS HÆMATITES, called also *Blood-stone*, is a Kind of ruddy Mineral in a Form of a Stone; thus called, either on Account of its resembling dry, curdled Blood, or of the Faculty it has of stanching of Blood.

Pliny reckons five Kinds, viz. the *Ethiopick*, the *Andromedas* or *Black*, the *Arabick*, the *Elalites*, or *Miltites*, and the *Schistos*; besides that commonly called the *Magnes Hæmatites*, from the Property it has of attracting Iron.

The five Sorts differ chiefly in Point of Hardness: The best, according to *Dioscorides*, is that which is friable, hard, black, and smooth, without either gritty Parts or Veins.

That commonly used by the Painters is factitious; being made of *Armenian Bole*, and other Drugs.

The native or fossil Kind comes from *Egypt*, *Bohemia*, &c. It has divers Uses in Medicine; being held cooling and astringent, and in that Quality prescrib'd in Hemorrhages. It is given in Substance, in Form of a fine Powder.

The Gilders use it for Burnishers, to polish their Gold withal.

The **ARMENIAN STONE**, **LAPIS ARMENUS**, is a Mineral Stone or Earth, of a blue Colour, spotted with green, black, and yellow; antiently brought only from *Armenia*, but now found in *Germany*, and *Tyrol*.

The *Armenian Stone* bears a near Resemblance to *Lapis Lazuli*, from which it seems only to differ in Degree of Maturity: They are distinguished by this, that the *Lapis Armenus* is softer, and instead of Sparks of Gold, is speckled with green.

Boerhaave ranks it among Semi-Metals; and supposes it composed of Metal and Earth. *Woodward* says it owes its Colour to an Admixture of Copper.

Its chief Use is in Mosaick Work, though it has some Place also in Physick.

APPENDIX.

Besides the above-mention'd Minerals or Fossils, there are others, as all Kinds of *Bitumen*, which in a general

Sense, is a fatty, tenacious, mineral Juice, very inflammable; or a fossil Body, which readily takes Fire, yields an Oil, and is soluble in Water.

Naturalists distinguish three Kinds of *Bitumens*, *hard*, *soft*, *liquid*, or *oily*; each of which they subdivide into several others.

Among the *hard Bitumens*, are ranked *yellow Amber*, sometimes *Amber-grease*, *Jet*, *Asphaltum* or *Jews-Pitch*, *Pissasphaltum*, *Pit-Coal*, *Black Stone*, and *Sulphurs*.

YELLOW AMBER, *Succinum*, or *Karabe*, is a yellow transparent Substance, of a bituminous Form or Consistence, but a resinous Taste, or Smell like Oil of Turpentine; chiefly found in the *Baltick Sea*, and along the Coasts of *Prussia*, &c.

Naturalists are infinitely divided as to the Origin of *Amber*: Some referring it to the Vegetable, others to the Mineral, and some even to the Animal Kingdom.

Those who refer it to the Vegetable Kingdom, say with *Pliny*, that it is a resinous Juice, oozing from aged Pines and Firs, (others say from Poplars, whereof there are whole Forests on the Coasts of *Sweden*) and discharged thence into the Sea; where undergoing some Alteration, it is thrown in this Form upon the Coasts of *Prussia*; which lie very low: He adds, that it was hence the Antients gave it the Denomination *Succinum*; from *Succus*, Juice. — This was also *Ovid's* Opinion, *Lib. 2. Metamorp.*

*Inde fluent lacrimæ, stillataque sole regeſcunt,
De ramis electra novis, quæ lucidus amnis
Excipit, & nuribus mittit geſtanda Latina.*

But the most modern Naturalists, who suppose it a compound Substance, say, that *Prussia*, and the other Countries which produce *Amber*, are moisten'd with a bituminous Juice, which mixing with the vitriolick Salts abounding in those Places, the Points of those Salts fix its Fluidity, whence it congeals: And the Result of that Congelation makes what we call *Amber*; which is more or less pure, transparent, and firm, as those Parts of Salt and Bitumen are more or less pure, and mixed in this, or that Proportion.

There are several Indications, which I have already taken Notice of in my Treatise of *Chymistry*, discovering where *Amber* is to be found. — The Surface of the Earth is there cover'd with a soft scaly Stone; and Vitriol in particular abounds there, which is sometimes found white, sometimes reduced into a Matter like melted Glass, and sometimes figured like petrified Wood.

Amber assumes all Figures in the Ground; that of a Pear, an Almond, a Pea, &c. Among others there have been found Letters very well formed; and even *Hebrew*, or *Arabick* Characters. Within some Pieces of *Amber* have also been found Leaves, Insects, &c. included; which seems to indicate, either that the *Amber* was originally in a fluid State; or that having been exposed to the Sun, it was soften'd, and render'd susceptible of the Leaves, Insects, &c. which came in its Way. The latter of these seems the more agreeable to the Phenomenon, in regard those Insects, &c. are never found in the Center of the Piece of *Amber*, but always near the Surface.

The most remarkable Property of *Amber* is, that when rubbed, it draws or attracts other Bodies to it; and this it is observed it does, even to those Bodies which the Antients thought it had an Antipathy to; as oily Bodies, Drops of Water, the Basilisk, Sweat of human Bodies, &c.

The *Peripateticians* attribute the Cause of this attractive Virtue to Sympathy only. But who can believe, that the *Succinum*, Glass, and the *Lacca*, with which the Sealing-Wax is made, &c. have such an Affinity with so many different Kinds of Corpufcles, as to have, all on a sudden, an Inclination to be joined with them? Besides that the Term Sympathy, expresses nothing clearly, but, on the contrary, confounds our natural Ideas.

Gassendus, *Sett. 1. Physic. lib. 6. de qualitat. rer. c. 14.* imagines, that the Effluvia which flowing from the *Amber*, being repelled by the Occurrence of the external Air, and losing their Motion, fall back on the *Succinum* with the lightest Corpufcles. But as the precious Stones and Glass, which have the same attractive Virtue with the *Succinum*, seem to have no such Viscosity, he should have

have assigned a more proper Cause to it.

Des Cartes, therefore, 4 *Part. princip. num.* 184. and following, is of Opinion, that some very thin Particles flow from the *Amber*, and other Bodies of that Kind, especially when they are strongly rubbed, which repel immediately the neighbouring Air, but as they do not, in the least, disorder in that Motion, the Mæatus appropriated to themselves, they are immediately pushed back by the same Air, towards the same Place whence they flowed; and along with them are carried those light Corpuscles, which consequently are joined to the Succinum, or Glass, or other Bodies of that Kind, rather by Impulsion than Attraction.

For my Part I am Opinion, that by the violent Friction, the Pores of those Bodies being extremely dilated, there then flow from them, and with Impetuosity, a great Quantity of small Corpuscles, which being all very tenacious, according to the Nature of the Body whence they flow, form by a continued Concatenation, a Kind of Chain, one End therefore remains, and the other lays hold or sticks to those light Bodies; but as that fastening cannot be made without some Motion of the Body fastened, in the very Instant of that Motion, that Body being sublimated by the ambient Air, is forced back by it, together with the Chain, which being also very light, cannot resist the Impulsion, towards the Body, whence the Chain proceeds. What can be said further of *yellow Amber*, may be seen in my Treatise of *Chymistry*.

JET, *Gagates*, called also *black Amber*, is a light, smooth, pitchy, fossil Stone, extremely black; formed of a bituminous Juice in the Earth, in the Manner of Coal.

It works like Amber, and has most of its Qualities: It abounds in *Dauphiné* in *France*; but the best in the World is said to be produced in *Yorkshire*. It readily catches Fire, Flashes, and yields a bituminous Smell.

There is also a factitious *Jet*, made of Glass, in Imitation of the Mineral *Jet*: This is drawn out into long hollow Threads, which are cut and fashioned at Pleasure. It is much used in Embroideries, and in the Trimmings of Mourning, and may be made of any Colour, though it is usually black and white; and of late denominated *Bugles*.

ASPHALTUM, or *ASPHALTOS*, is a solid, brittle, black, inflammable, bituminous Substance, resembling Pitch, brought from the East, and particularly *Judea*; whence it is also called *Jew Pitch*.

The *Asphaltos* of the *Greeks*, is the Bitumen of the *Latins*. Though modern Naturalists, who make a Class of Bitumens, place *Asphaltos* at the Head of it, as being the furthest matured and concocted of the whole Tribe; but consisting of the same simple Principles as the rest. It is chiefly found swimming on the Surface of the *Lacus Asphaltites*, or Dead Sea, where antiently stood the Cities of *Sodom* and *Gomorrha*. It is cast up from Time to Time, in the Nature of a liquid Pitch, from the Earth, which lies under this Sea; and being thrown upon the Water, swims like other fat Bodies, and condenses by little and little, through the Heat of the Sun, and the Salt that is in it: It burns with great Vehemence; in which it resembles *Naphtha*, but is thicker as to Consistence.

The *Arabs* use it to pitch their Ships withal, as we do common Pitch. Besides, there was a deal of it employ'd in the embalming of the Antients.

It is supposed to fortify, and resist Putrefaction; resolve, attenuate, cleanse, and cicatrize Wounds: But is little used among us, either externally or internally.

It is usual to sophisticate the *Asphaltos*, by mixing common Pitch along with it; the Result whereof makes the *Pissasphaltum*, which the Coarseness of the black Colour, and the stid Smell easily discover. Others, however, will have its pitchy Quality natural to it, and suppose *Pissasphaltum* to be the native *Asphaltum*.

ASPHALTUM also denotes a Kind of bituminous Stone, found near the antient *Babylon*, and lately in the Province of *Neufchatel*; which mixed with other Matters, makes an excellent Cement, incorruptible by Air, and impenetrable by Water; supposed to be the Mortar so much celebrated among the Antients, wherewith the Walls of *Babylon* were laid. It yields an Oil which defend Ships from Water, Worms, &c. much better

than the ordinary Composition; and which is also of good Service for cleansing and healing of Ulcers, &c.

PISSASPHALTUM, denotes a native, solid Bitumen; found in the *Ceraunian* Mountains of *Apollonia*; of an intermediate Nature between Pitch and Asphaltum.

Pissasphaltum, is also a Name given to a factitious Substance, compounded of Pitch and Asphaltos, or Bitumen Judaicum.

PIT-COAL, is ranked among the Number of Minerals, and the Places it is dug out of are called *Coal-Mines*, or *Coal-Pits*. — It is common in most Countries of *Europe*; though the *English* Coal is of most Repute, even in foreign Countries; notwithstanding some pretend, that of the *Fosse* in *Auvergne* is not any Thing inferior to it.

The Goodness of Coal consists in its being as free as possible from Sulphur, in its heating Iron well, and in its burning a long Time in the Smith's Forge. The *English* Coal has this Particular to it, that it never lights so perfectly, as when Water is thrown on it.

In the Memoirs of the Royal French Academy, we have an Account of two Experiments on the common *Pit-Coal*, made by M. *des Landes* while in *England*, and which he thinks have escaped the *English* Philosophers.

1. Pounding some *Coal*, and putting half an Ounce of it in a Vial of Water, the Mixture becomes quite black: But leaving it exposed to the Air in a Window, during a cold Winter Night, in the Morning it was found frozen, and turn'd to a reddish Colour. The Reason of this Change must be, that the sulphurous Particles of the *Coal* having been penetrated by the saline ones of the Water, had formed together a certain Coagulum; whereby those Particles acquiring a Position different from that they had before the *Coal* was reduced into Powder, reflected the Light, likewise, in a different Manner.

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These, according to all Appearance, must be the Work of subterraneous Fires, which raise or sublime the more subtle Parts of certain bituminous Matters that lie in their Way. These Parts being condensed into a Liquor by the Cold of the Vaults of Rocks, are there collected, and ooze thence through Clefts and Apertures, which the Disposition of the Ground furnishes them withal. *Petrol*, then, is a black liquid Bitumen; only differing by its Liquidity from other Bitumens.

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They believe, that it is highly probable, that the Juice which filled the Cavities of the Letters, was brought thither from the Bottom of its Roots; nor is there any more Difficulty in conceiving this, than in comprehending how the Sap should pass from the Roots of our largest Oaks, to the very Extremity of their highest Branches.

It must be own'd, the Heart of these Trees is exceedingly hard, and yet those of Brazil, called *Iron Wood*,

have assigned a more proper Cause to it.

Des Cartes, therefore, 4 *Part. princip. num.* 184. and following, is of Opinion, that some very thin Particles flow from the *Amber*, and other Bodies of that Kind, especially when they are strongly rubbed, which repel immediately the neighbouring Air, but as they do not, in the least, disorder in that Motion, the Meatus appropriated to themselves, they are immediately pushed back by the same Air, towards the same Place whence they flowed; and along with them are carried those light Corpuscles, which consequently are joined to the Succinum, or Glass, or other Bodies of that Kind, rather by Impulsion than Attraction.

For my Part I am Opinion, that by the violent Friction, the Pores of those Bodies being extremely dilated, there then flow from them, and with Impetuosity, a great Quantity of small Corpuscles, which being all very tenacious, according to the Nature of the Body whence they flow, form by a continued Concatenation, a Kind of Chain, one End therefore remains, and the other lays hold or sticks to those light Bodies; but as that fastening cannot be made without some Motion of the Body fastened, in the very Instant of that Motion, that Body being sublimated by the ambient Air, is forced back by it, together with the Chain, which being also very light, cannot resist the Impulsion, towards the Body, whence the Chain proceeds. What can be said further of *yellow Amber*, may be seen in my Treatise of *Chymistry*.

JET, *Gagates*, called also *black Amber*, is a light, smooth, pitchy, fossil Stone, extremely black; formed of a bituminous Juice in the Earth, in the Manner of Coal.

It works like Amber, and has most of its Qualities: It abounds in *Dauphiné* in *France*; but the best in the World is said to be produced in *Yorkshire*. It readily catches Fire, Flashes, and yields a bituminous Smell.

There is also a factitious *Jet*, made of Glass, in Imitation of the Mineral *Jet*: This is drawn out into long hollow Threads, which are cut and fashioned at Pleasure. It is much used in Embroideries, and in the Trimmings of Mourning, and may be made of any Colour, though it is usually black and white; and of late denominated *Bugles*.

ASPHALTUM, or *ASPHALTOS*, is a solid, brittle, black, inflammable, bituminous Substance, resembling Pitch, brought from the East, and particularly *Judea*; whence it is also called *Jew Pitch*.

The *Asphaltos* of the *Greeks*, is the Bitumen of the *Latins*. Though modern Naturalists, who make a Class of Bitumens, place *Asphaltos* at the Head of it, as being the furthest matured and concocted of the whole Tribe; but consisting of the same simple Principles as the rest. It is chiefly found swimming on the Surface of the *Lacus Asphaltites*, or Dead Sea, where antiently stood the Cities of *Sodom* and *Gomorrha*. It is cast up from Time to Time, in the Nature of a liquid Pitch, from the Earth, which lies under this Sea; and being thrown upon the Water, swims like other fat Bodies, and condenses by little and little, through the Heat of the Sun, and the Salt that is in it: It burns with great Vehemence; in which it resembles *Naphtha*, but is thicker as to Consistence.

The *Arabs* use it to pitch their Ships withal, as we do common Pitch. Besides, there was a deal of it employ'd in the embalming of the Antients.

It is supposed to fortify, and resist Putrefaction; resolve, attenuate, cleanse, and cicatrize Wounds: But is little used among us, either externally or internally.

It is usual to sophisticate the *Asphaltos*, by mixing common Pitch along with it; the Result whereof makes the *Pissasphaltum*, which the Coarseness of the black Colour, and the fetid Smell easily discover. Others, however, will have its pitchy Quality natural to it, and suppose *Pissasphaltum* to be the native *Asphaltum*.

ASPHALTUM also denotes a Kind of bituminous Stone, found near the antient *Babylon*, and lately in the Province of *Neufchatel*; which mixed with other Matters, makes an excellent Cement, incorruptible by Air, and impenetrable by Water; supposed to be the Mortar so much celebrated among the Antients, wherewith the Walls of *Babylon* were laid. It yields an Oil which defend Ships from Water, Worms, &c. much better

than the ordinary Composition; and which is also of good Service for cleansing and healing of Ulcers, &c.

PISSASPHALTUM, denotes a native, solid Bitumen; found in the *Ceraunian* Mountains of *Apollonia*; of an intermediate Nature between Pitch and Asphaltum.

Pissasphaltum, is also a Name given to a factitious Substance, compounded of Pitch and Asphaltos, or Bitumen Judaicum.

PIT-COAL, is ranked among the Number of Minerals, and the Places it is dug out of are called *Coal-Mines*, or *Coal-Pits*. — It is common in most Countries of *Europe*; though the *English* Coal is of most Repute, even in foreign Countries; notwithstanding some pretend, that of the *Fosse* in *Auvergne* is not any Thing inferior to it.

The Goodness of Coal consists in its being as free as possible from Sulphur, in its heating Iron well, and in its burning a long Time in the Smith's Forge. The *English* Coal has this Particular to it, that it never lights so perfectly, as when Water is thrown on it.

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It must be own'd, the Heart of these Trees is exceedingly hard, and yet those of *Brazil*, called *Iron Wood*, *Guaiacum*

Guaiacum and Ebony are much harder. Coral is as hard in the Sea as out of it; and Sea Mushrooms, which every Body allows to grow, are true *Stones*, and so like the common *Stones*, are used in *America* to make Lime of.

None, they believe, ever doubted that Shells grow by means of a nutritious Juice; and yet this Juice is conveyed along the narrow Canals of these excessive hard Bodies, as well as through those of Plants, which are much less hard.

Some *Stones* then, conclude they, must be allowed to vegetate and grow like Plants; but this is not at all probable; they are generated in the same Manner, at least there are Abundance of *Stones*, whose Generation is inconceivable, without supposing they come from a Kind of Seeds, wherein the organical Parts of the *Stones* are wrapped up in little, as those of the largest Plants are in their Grains.

The *Stones* called *Cornu Ammonis*, *Lapis Judaicus*, *Astroites*, those of *Bologna* and *Florence*, the several Kinds of Pyrites, Sea Mushrooms, Crystals of the Rock, and an Infinity of others, suppose, in their Opinion, their several Seeds; as much as Mushrooms, Truffles, and various Kinds of Mosses, whose Seeds were never yet discovered.

They ask how the *Cornu Ammonis*, which is constantly in Figure of a Volute, should be formed without a Seed, containing that same Structure in little? Who moulded it so artfully? And where are the Moulds? Far from this, say they, these Kinds of *Stones* are found in the Earth like common Flints. Nor were either Moulds, or any Thing like them ever discovered.

M. *Tournefort* examines the several Kinds of *Stones* above-mentioned, and finds them under the same Necessity of Seed. Again that immense Quantity of Flints wherewith the Crow of *Arles* is covered, is a strong Argument in behalf of this Theory.

The Country there for twenty Miles round, as I have already observed in another Place, is full of roundish Flints; which are still found in equal Abundance, to whatever Depth you dig. M. *Peirese*, who first proposed the Generation of *Stones* by means of Seeds (tho' he took the Word Seed in a very different Sense from M. *Tournefort*) first brought this extraordinary Campaigne as a Proof thereof. He asks, how could so many similar Flints be formed? There is no saying they are coeval with the World, without assenting at the same Time, that all the *Stones* on the Earth were produced at once; which were to go directly contrary to the Observations above-mentioned.

Among the Seeds of *Stones* M. *Tournefort* observes, there are some which do not only grow soft by the Juices of the Earth, but even become liquid. These then, if they penetrate the Pores of certain Bodies, grow hard, petrify, and assume the Figure or Impression of the Body: Thus what we call *Putinites*, *Conchites*, *Mytilites*, *Ostracites*, *Nautilites*, *Echinites*, &c. are real *Stones*; the liquid Seeds whercof have insinuated into the Cavities of the Shells called *Puten*, *Concha*, *Mytilus*, *Cyprea*, *Nautilus*, *Echinus*.

On the contrary, if those liquid Seeds fall on Flints, on Shells, Sand, &c. they inclose those several Bodies, and fixing between them form a Kind of Cement, which yet grows like other *Stones*. It is highly probable, that such Rocks as are only an Assemblage of masticated Flints, have been formed by a Number of these liquid Seeds, in like Manner as the Quarries full of Shells; unless the Rocks have unveloped those Bodies in their Growth.

He adds, that there are Seeds of real *Stones* inclosed in the Spawn of certain Shell-fish, as well as that hard solid Matter, destined to the forming their Shells.

There is a particular Kind of Shell-fish, called *Pholas*, which is never found any where but in the Cavities of Flints, which are always found exactly fitted to receive them. Now, it is highly improbable the Fish should come and dig such a Nitch to spawn in; it is much more likely, the *Stones* they are found inclosed in were at first soft, and that the Matter they are formed of was originally found in the Spawn, in like Manner as the Matter which forms the Egg-shell, is really found in the Seed thereof.

From the whole he concludes, that the Seed of *Stones*, and even of Metals, is a Kind of Dust which probably fall from them when they are alive, *i. e.* while they continue to vegetate as above. This Dust may be compared to the Seeds of several Plants, as those of Ferns, Capillaries, Mokes, Truffles, &c. which no Microscope ever yet discovered; though their Existence is not at all to be doubted.

Some imagine, that Flints and Pebbles are among *Stones* what Truffles are among Plants; nor is this Opinion new: *Pliny* assures us, that *Theophrastus* and *Margory Nazianzen* adds, that there were Authors who even believed that *Stones* made Love.

This Theory of M. *Tournefort*, on the Origin and Formation of *Stones* is very ingenious, and has a great deal of Probability in it; but it does not seem to me entirely satisfactory; for though he tells us that *Stones* are produced from Seeds and formed by Vegetation, he does not inform us how those Seeds are fecundated in the Entrails of the Earth, and in what Manner the organical Vessels, through which the nutritious Juice circulates, are configured, and disposed throughout the whole Body of the *Stone*; how that Circulation is accomplished, and what gives its first Impulsion.

For my Part, was I to espouse his Sentiment, and account for it, without having Recourse to that chimerical Dust, which he admits for the Seed of *Stones*; I would say, that the Matrices where *Stones* are formed, contain, like those of Metals and Minerals, certain saline Particles, and a Kind of Earth naturally disposed from the Beginning of the World, to be configured so as to form together a certain Compound, when put into Motion, and approached nearer one another by a powerful Agent, by which Approximation, and closer Union of their Parts, they are rendered capable of being fecundated by the same powerful Agents; therefore I would consider the Matrices of *Stones* as a Kind of Ovary, where Nature keeps always a vast Quantity of those first Principles, which I will call Eggs, ready to receive the Impressions of the Agent, which loosening them from the Earth they were adherent to, after it has thus united them together, brings them into a Place more convenient for the Formation of an Embryo, on which it continues working, till by degrees it has unfolded all the organical Parts, and appropriated every one of them to the particular Use Nature has designed it for; leaving in them, after it has perfected its Work, the first Principle of Motion, to usher through them the nutritious Juice, which they receive from the Matrice they have been formed in, as from a Placenta, by means whereof the *Stone* vegetates and grows, till it has acquired the Bulk prescribed by Nature. And when that *Stone* is taken out of its Matrice, another Egg is loosened from the Ovary, and brought in the same Place for the same Purpose; and where a new *Stone* is formed, unless the Matrice be vitiated.

M. *Geoffroy* accounts for the Origin and Formation of *Stones* in a different Manner. He lays it down as a Principle, that all *Stones* without Exception have been fluid, or at least a soft Paste now dried and hardened; witness the *Stones* where are found foreign Bodies, witness also figured *Stones*, &c.

On this Principle he examines the Formation of the different Kinds of *Stones*; and shews, that the Earth alone suffices for the same, independant of all Salts, Sulphurs, &c. The metallick Particles contained in Flints give them their Colour, but these are only Accidents, for Proof of which he instances the Sapphires and Emeralds of *Auvergne*, which lose all their Colour by a moderate Fire consuming their metallick Parts; but without any Damage to their Transparency, their being hereby rendered mere Crystals.

To view Rock Crystal, indeed, one would not take it for Earth; and yet Earth it must be, not Water coagulated, as the Antients imagined.

M. *Geoffroy* conceives two Kinds of primitive Principles in the Earth. Those of the first Kind are exceedingly fine, thin Lamellæ, equal to each other, or nearly so. Now, when these meet together from any Cause whatever, in a sufficient Quantity, the Regularity

Equality of their Figures determines them to range themselves equally and regularly; and thus to form a homogeneous Compound, which is very hard, from the immediate Contact of the Parts, and very transparent by reason of their regular Disposition, which leaves a free Passage to the Rays of Light every Way; and this is Crystal.

The Parts of the second Kind have all Sorts of irregular Figures, and must accordingly form Assemblages which are much opaker and less hard. Now Crystal is formed wholly of Parts of the first Kind, and all other Stones of a Mixture of two Kinds of Parts together: This Mixture is absolutely necessary, in order to unite and bind together the Parts of the second Kind, and give them a Hardness and Consistence, without which they would only make a Sand, or Dust. Water now appears the fittest Vehicle, to carry the Parts of the first Kind. This is seen from several petrifying Springs, which incrustates the Pipes through which their Waters are conveyed, or even solid Bodies laid in the Earth for some Time: The Water does not dissolve those earthy Parts, it only keeps them in Fusion, as it does the Juices wherewith Plants are fed.

This Water, thus charged with earthy Particles of the first Kind, M. Geoffroy calls the *stony*, or *crystalline Juice*, whereof those Bodies are primarily formed.

Neither is this Sentiment of M. Geoffroy entirely satisfactory: For though he lays down two Kinds of primitive Particles in the Earth for the Formation of Stones, viz. exceedingly fine, and thin Lamellæ, for the Formation of transparent Stones: The Regularity and Equality of the Figures thereof determine them to range themselves equally and regularly. And others, which have all Sorts of irregular Figures, for the Formation of opaque Stones, he seems to go no further; and leaves us in the Dark, as to the Increase of Stones. He also appoints Water for the Vehicle of those Particles; but he is not so kind to inform us how that Operation is performed; for though he says that the Water keeps those earthy Parts in Fusion, as it doth the Juices wherewith Plants are fed, as he is pleased to imagine, he does not pretend that there are Vessels in Stones, as in Plants, to convey that Water through.

Therefore, to support his Sentiment, I would say, rejecting all Kinds of Vehicles whatever, that those exceedingly fine and thin Lamellæ, which he considers as the primitive Particles of transparent Stones, are nothing else but Salts much depurated of earthy Particles, and crystallised in the Entrails of the Earth: That those Crystals being very soft in their first Formation, are united together by a *juxta Position*; and form a larger, or lesser Compound in Proportion, as there is in the Quarry a greater or less Abundance of those Salts they are formed of; that as that saline Matter is most commonly very deep in the Earth, and most commonly reaches from thence to its Superficy, hence arise those Stones of an immense Bulk, which offer themselves to our Sight; by the Earth around it giving Way to fill the Cavities, left by the saline Matter uniting itself thus closer to form the Compound.—That the transparent Stones are always much smaller than the opaque ones, because there is but a very small Quantity of that purified Salt they are formed of, in Comparison to the coarse saline Particles, which with a vast Quantity of earthy ones, enter into the Composition of opaque Stones.

Mr. Boyle observes, that a competent Knowledge of the Nature of the Sap or Juice found in Stones used in Building, is of the last Importance; the same Stone dug out of the same Quarry at one Season, being found to moulder away in a few Winters, which dug at another Season, will brave the Weather for many Ages; and there are others, which, though dug at the proper Season, yet make but ruinous Buildings, if used at an improper Season.

The same Author adds, that as there are some Sorts of Stones which will decay in a few Years, there are others will not have attained their full Hardness in thirty or forty Years, or even much more.

Bishop Wilkins divides Stones into *vulgar*, *middle Price*, and *precious*.

Vulgar Stones, or such as are of little Price, are

distinguishable by their different Magnitudes, Uses, and Consistence, into the

- Greater Magnitudes of Stone used either about Buildings, whether of
 - Walls; chiefly being of a
 - Softer Consistence, whether natural or factitious,
 - 1. { *Free-Stone*,
Brick.
 - Harder Consistence; not easily yielding to the Tool of the Workman, growing either in
 - Great Masses,
 - 2. *Raggs*.
 - Lesser Masses; whether such as are for their Figure,
 - More knobbed, and unequal, used for striking of Fire, either the more common, which is less heavy; or less common, which is more heavy; as having something in it of a metalline Mixture,
 - 3. { *Flint*,
Marcasite. *Fire-Stone*.
 - More round and even,
 - 4. *Pebble*, *Thunderbolt*.
 - Roof, or Pavement, being of a luminated Figure, either natural, or factitious.
 - 5. { *Slate*,
Tyle.
 - Metals, either for the
 - Sharpening or trying of them,
 - 6. { *Whet-Stone*,
Touch-Stone.
 - Polishing, or Cutting them; being either of a more spongy and soft, or of a more hard Consistence.
 - 7. { *Pumice*,
Emery.
 - Lesser Magnitudes, either more, less, or minute.
 - 8. { *Sand*,
Gravel.

- 2. *Middle priced Stones*, are either of a Shining Politure, or capable of it; whether of a simple white Colour, and more soft Consistence,
 - 1. *Alabaster*.
Sometimes white, sometimes black, or green, and sometimes variegated with Veins, growing in greater or less Masses,
 - 2. { *Marble*, *Porphyry*,
Agat.
Spotted with red, upon a greenish Colour, or with Spots of Gold Colour upon blue,
 - 3. { *Jaspis*, *Heliotryx*,
Lazuli, *Azure Stone*.
- Transparency, either
 - brittle; whether natural or factitious,
 - 4. { *Crystal*,
Glass.
 - Fissile into Flakes, either greater or lesser,
 - 5. { *Sclatine*, *Muscovia Glass*, *Ising-Glass*,
Talc. { *Spar*,
- Relation to Metals, attracting Iron, or making of Bras.
 - 6. { *Load-Stone*,
Cadmia, *Calaminaris*.
- Incombustible Nature,
 - 7. *Amiantus*, *Asbestos*.
- Strange Original; not being properly Minerals, tho' usually reckoned among them; but either a submarine Plant, or supposed to proceed from a liquid Bitumen,
 - 8. { *Coral*, *Coralline*,
Amber.

Precious Stones he subdivides into *more* and *less transparent*.

The *less transparent* he distinguishes by their Colours, into red, as the *Sardian* and *Cornelian*; pale, fleshy Colours, like that of a Man's Nail, as the *Onyx*; blueish, as the *Turquoise*; pale Purple, as the *Chalcedony*; and those of various Colours, as *Opal* and *Cat's Eye*.

The *more transparent* he distinguishes into such as are colourless, as the *Diamond* and *white Sapphire*; and coloured, which are either red, as the *Ruby*, *Carbuncle*, and *Granate*; yellow, as the *Chrysolite* and *Topaz*; green, as the *Emerald*, *Smaragd*, and *Beryl*; blueish,

as the *Sapphire*; and purple or violaceous, as the *Amethyst* and *Hyacinth*,

EARTH, as we take it in this Place, is also a fossil or terrestrial Matter, whereof our Globe principally consists; whose Character is to be neither dissoluble by Fire, Water, nor Air; not transparent, more fusible than Stone, and generally containing some Degree of Fatness.

Of such *Earths*, some are simple and immutable; others compound and fatty. Of the first Kind is *Chalk*, *Pumice*, and *Rotten-Stone*. Of the second or compound Kind, are *Boles* of all Kinds, red, white, and brown; *Fuller's Earth*, the divers Kinds of medicinal Earth, as the *Cretica*, *Hungarica*, *Turcia*, *Suecia*, *Lemnian Earth*, *Malta Earth*, *Terra Sigillata*.

With Regard to the *simple Earths*. CHALK, is a white fossil Substance, usually reckoned as a Stone; but Dr. *Stare* thinks, without Reason; since when examined by the hydrostatical Ballance, it is found to want much of the Weight and Consistence of a real Stone: So that he thinks it more justly ranked among the *Earths*.

This he observes to be the Case, not only in *Chalk*, but various other Bodies, taken for granted to be Stones; some whereof are nearer to Earth than Stone; others nothing but Earth, Sulphur, Metal, &c.

PUMICE, reckoned by a great Number of Naturalists, as a Kind of spongy Stone, very porous and friable; is by others consider'd as a Kind of Earth: Neither are they agreed about the Nature and Origin of *Pumice*. Some look on it as Pieces of Rock half-burnt and calcined, cast up in Eruptions of Vulcano's, particularly *Aetna* and *Vesuvius*, into the Sea; and which being there washed in the Salt-Water, lays aside the black Colour, that the Impression of the subterranean Fires had given it, and becomes whitish, or sometimes only greyish, according as it has floated more or less in the Sea.

Dr. *Woodward* considers *Pumice*, as only a Sort of Slag, or Cinder; and affirms, it is only found either where Forges of Metals have antiently been, or near some Vulcano or burning Mountain.

Other Authors will have the *Pumice* to rise from the Bottom of the Sea; whence they suppose it detached by subterraneous Fires. And hence account both for its Lightness and Porosity, and its saline Taste; alledging, in Confirmation hereof, that *Pumice* is frequently found in Parts of the Sea far remote from all Vulcano's; and adding, that several Parts of the *Archipelago* are frequently found cover'd with it, all at once, after a few inward Shakes and Heavings of the Bottom of the Sea.

Pumice makes a very considerable Article in Commerce, and is much used in the Arts and Manufactures, to polish and smooth several Works.

Its Pieces are of several Sizes: The Parchment-makers and Marblers use the largest and lightest. The

Curriers the heaviest and flattest. The Pewteers the smallest.

Pliny observes, that the Antients made considerable Use of *Pumice*, in Medicine; but it is out of the present Practice.

As to the second, or *compound Kind of Earths*. *Boles* abound with Salts of different Forms or Figures. For the Spirit of Vitriol, which is an acid, poured upon the *Armenian Bole*, causes no Ebullition; but if it be poured upon the *Terra Sigillata*, or *Lemnian Bole*, it will excite a very great Effervescence, or Ebullition; which denotes a very great Variety of Salts in those *Earths*, or *Boles*.

The *Armenian Bole*, popularly, though corruptly called in *English*, *Bole Armoniack*, is a soft, friable, fatty Earth, of a pale red Colour; easily pulverized, and which adheres to the Tongue; esteemed a good Dyer, styptick, and vulnerary; and in these Qualities used in divers Diseases, both internally and externally.

This *Bole* is easily falsified; and the Druggists frequently sell *Lemnian*, or other Earth in lieu thereof. *Mathoilus* says, it is found in Gold, Silver, and Copper-Mines.

Bole of the Levant, is a medicinal Earth brought from the *Levant*; nearly of the same Nature, and having the same Uses with the *Armenian Bole*.

Pomet says, there is no such Thing among us, as either true *Bole Armoniack*, or *Bole of the Levant*; and that all the *Boles* now in Use, are brought either from the Provinces of *France*, or the neighbouring Countries: But this does not seem sufficiently warranted; and the new *Tarifs*, or Duties on Goods, imported into *France*, which mention them both, make it credible, that there are of either Kind imported into that Kingdom. Indeed it appears, that it is the *Levant Bole*, which usually passes among us for the *Armoniack*.

FULLERS-EARTH, is a fatty, fossil Earth, abounding in Nitre; of great Use in the Woollen Manufacture.

TERRA SIGILLATA, is a Kind of Earth or Bole, dug in the Isle of *Lemnos*, and thence also called *Lemnian Earth*, of considerable Use in Painting and Medicine.

It is of different Colours, but most commonly red; heavy, soft, and friable; held very astringent, and as such used in Hæmorrhages; as also against the Plague, and Poison, though I would not trust to it in those dangerous Cases. *Pliny* attributes to it several other Virtues, which Experience does not justify; nor is it in that Esteem it antiently was; yet it is still an Ingredient in Venice-Treacle.

It was antiently found in a Mountain, in the Neighbourhood of the City *Hephæstia*; where *Diana's* Priests went at certain Times with great Ceremony to dig it up. After a little Preparation they made it up in *Troches*, and sealed them with *Diana's* Seal; whence the Appellation of *Sigillata*, sealed.

It is now brought from *Constantinople* in little flat Cakes, round on one Side, flat and sealed on the other.

MINERAL-WATERS.

MINERAL-WATERS, are those which at their springing forth from under Ground, are found impregnated with some *Mineral Matter*, as Salt, Sulphur, Vitriol, &c.

Most of the Matters wherewith the *Mineral-Waters* are impregnated, are not discernible in them, and the divers Mixtures made in them of several of those Matters together, constitute so many different Kinds of *Mineral Waters*, either wholesome or pernicious, that it is impossible to know and determine them all.

The Waters of the same Springs, can, in divers Times, receive notable Alterations or Changes, by new Mixtures, or by those which have been made being entirely exhausted.

Some have imagined, that *Mineral-Waters* are produced entirely of the *Mineral Vapours* exhaling from Mines, and condensed; but it is not very likely,

that there are, in the Earth, Mines abundant enough to furnish Vapours, capable, being condensed, to keep out the perpetual Course of those Waters, in Sources which are inexhaustible. But it may happen, that some *mineral Vapours* or Exhalations, are mixed with the common Waters which run through the Earth, where they are to be met with, and condensed; and that those Waters remain impregnated with their Qualities, and with some volatile Salts, not concrete, sublimated in those dry Exhalations, or in those humid Vapours. It is not very easy to discover those Exhalations and Vapours. The Variety of their Matters is very great, their Mixtures are accidental; the Qualities of the Places they run through, and where they are stopped, are not evident, and the Alterations they produce in the Waters they are mixed with, are not always manifest.

It is equally difficult to discover the Juices which can be mixed with the *Mineral Waters*, and particularly those which receive no Concretion, and communicate no sensible Quality to those Waters; for those liquid and entirely volatile Juices, pass in the Distillation, with the Matter of the Water, and are only manifested by Effects which simple Water cannot produce.

The Juices, called Concretes, because they can be condensed, and resolved, have Sediments, which render them visible and palpable after the Distillation or Evaporation of the Water they are mixed with. But it is very difficult to discover their Kind and Properties, if they have no respect to those which are already known, or if they be several together.

The Salts and Earths, are the most sensible, and most common Matters, mixed in Springs and Well Waters. There is seldom any Earth which does not participate of some Salt dissoluble in the Waters which pass through them; and the Current of those Waters, carries off always likewise some subtle Earth; and this is what is found the most manifest in those Waters: But the Knowledge of those Salts and Earths mixed in the Waters, is not always so distinct, that one can determine the Species thereof, and form a sure Judgment of their Properties.

There are but very few concrete Salts known to us. There may be several of them, which have respect to the common Salt, Nitre, Allum, and Vitriol, which are the four most common Kinds of *mineral* concrete Salts. Those whose Propensity to Concretion is not accomplished, and which are yet in Embrio, and as in their Seminary or first Being, are less discernible in that State, and those which are better formed, and already Concretes, or capable of Concretion, which some call *enixi*, i. e. born, and came out of their Matrices, have no simple and homogeneous Substances in each Species.

The common Salt has two different Portions mixed together; one is condensed and crystallised, in the Cold, and in a damp Place, after the Evaporation of Part of the Water, in which that Salt has been dissolved; the other is neither condensed nor crystallised, but by the total Evaporation of the rest of the Water. That the Portion crystallised in the Cold, or in a damp Place, is the most sulphurous, and by its Sulphurity is easily mix'd with sulphurated Salt of Tartar, calcined and resolved in a damp Place, or in common Water, without Coagulation: But that Part of the common Salt which is not condensed but by the total Evaporation of the Water, in which it has been dissolved, has an Acidity, which immediately coagulates the Salt of Tartar in Solution, and all other fixed, sulphurous and nitrous Salts.

The Vitriol which crystallises, in a damp Place, on sulphurous Marcasites, has, likewise, a succulent Portion, condensable only by the total Evaporation of its aqueous Humidity, of a very acid Taste, of an unctuous Substance, and soon resolved in a humid Place; which different Portion is very different from that, which is condensed first, and crystallised in the Cold, in the Water where that Vitriol has been dissolved. Those Crystals are a pure, acid, austere Vitriol; a great deal of the *mineral* Earth whereof is precipitated by the Mixture of the sulphurous and nitrous Salts, with which the other Coction can be easily mixed, having not, like the first, that Acidity, on which the sulphurous Salts can act. Which is otherwise in the common Salt, the first Portion whereof is the most sulphurous, and the second the most acid.

True Nitres, are, likewise, composed of two different saline Portions, one more sulphurous, which can be crystallised in a cold or damp Place, and another which dissolved after that Crystallisation, and which is not condensed but by a Heat strong enough to expel all the dissolutive Humidity, is less sulphurous, and has some Acidity, which the other has not.

The first Beings or Embrios of the *mineral* Salts are but Vapours, or Juices not concrete, entirely vaporious, some of which can be condensed and fixed in Part, by the Action of Fire; or be disengaged from their Matrices, and rendered capable of Concretion by means of the Air; which is observed in certain nitrous, aluminous, and vitriol Salts. The sulphurous Salt, found in the Calx of certain hard Stones burnt in the Fire, and which is a kind of true Nitre, had its Seminary in the Stones before they were burnt; and in that State of its first Be-

ing, is very different from that it requires in the Fire, which of cold and coagulative, renders it caustick and resolute. The cold and coagulative Quality of that stony Salt, in its first being, manifests itself sufficiently in the Waters of the Springs of certain Rocks; which are very limpid and cold, and causes cold and scirrhus Tumours, to those who use it for common Drink. That Seminary of stony Salt, is rendered nitrous, sulphurous, caustick, and resolute by Fire, which could exhaust it; but not produce it, in calcining those Stones, no more than that of burnt Shells of Oysters, of which also they make Chalk, which has no less of sulphurous Salt. This Salt embrioned in the Stones of Chalk, is a stony Juice, which can be mixed with the Waters which run between the Beds and Interstices of those Stones in the Rocks; but which is not easily discovered in the Waters impregnated therewith.

The Seminary of Allum and that of Vitriol must be likewise in the Matters whence those Sorts of Salts are extracted by means of Water, after their Calcination in the Fire, and their Maceration in the Air. The Fire and Air which have exalted them, could not produce them. The Seminary of Allum in the aluminous Stones, and that of Vitriol in the sulphurous Marcasites, are not, in that State, manifest to our Senses; and often are no otherwise known in *Mineral Waters*, but by some Effects, and even that without any Certainty, because those Effects can be equivocal.

All those Varieties of mineral Salts embrioned, *enixi*, chrysalin, succulent, sulphurous, not sulphurous, of the first, and of the second Concretion, those of their Genders, Species, Mixtures, Proportions, Alterations, &c. render difficult and uncertain, the Judgment of the Properties of the Waters participating thereof.

The subtle Earth mixed likewise in the *Mineral-Waters*, can be likewise of several Sorts difficult to discover. Those Earths are found in them, of divers Colours, white, grey, yellowish, red, brown, and of different Qualities. The one is dissoluble in distilled Vinegar, the others indissoluble; the one fusible, the other not fusible in the Fire, where they assume divers Colours; the one argillous, the other cretaceous, bolar, sandy, talquous, calcinous; the one produced by the Concretion of certain saline, or sulphurous Juices, the others not; the one simply mineral, the other metallick. Most of those Kinds being not easily discerned separately, are still less discovered when mixed together.

The simple Infusions of certain sulphurous mineral Earths, can cause a notable Alteration in common Waters, though nothing of those Earths is left in their Sediments after Distillation, as there's none seen in certain Liquors rendered reunitive by the simple Infusion of Antimony.

Hot Mineral-Waters can contract some Alteration by the sulphurous and bituminous Matters they meet with in their Course; for those Matters partake of certain subtle Salts, which those Waters can dissolve and carry off along with them.

Some Mineral-Waters cold, or luke-warm, have a sourish or vinous Flavour, which is not discovered in any of those which are not notably hot; but that Flavour is so easily lost by the least Heat, or in the Air, that it is difficult to discover what causes it. There is not so much as any found in the Waters thought to be aluminous and vitriolick, but likewise in the Waters which are manifestly nitrous, and which abound in sulphurous Salts opposed to Acids.

The Causes of Heat of certain *Mineral-Waters* are little known. There is Room to doubt if there be subterraneous Fires capable of heating them, or if they have received that Heat by the Exhalations of some fermentable mineral Juices, or wherein an Ebullition arises from the Mixture of other Juices.

To discover the Nature and Qualities of *Mineral-Waters*, the following Method is to be observed.

1. From what Place they are.—2. In what Time, or Disposition of the Air they have been taken in their Springs.—3. If they are sent in Bottles to the Physician who is to examine them, he must enquire how long they have been in Bottles, and if the Bottles were clean, and have been well corked.—4. If they have made some Sediment in the Bottles, and of what Kind.—5. If those

Waters are limpid or muddy.—6. If they have some Smell and some manifest Flavour.—7. If their Weight differs notably from that of simple and common Water.—8. If they change Colour by being mixed with Galls, or Oak-Leaves, or Pomegranate's Peel, Myrabolans, &c.—9. If having been exposed to the Air, or a little heated, they are no longer susceptible of Colour.—10. If being put in Distillation through the Alembick, in Balneo-Mariæ, there arises and distills first some Liquor more subtle than the rest, and if there be found some Differences between the diverse Portions of the same Water distilled, received separately.—11. If in the Evaporation or Distillation of those Waters, at a very moderate Heat, some Pellicles be formed on the Surface of the Water; or if some terrestrial Concretions be made floating by Flakes in the Water, or adhering to the Sides of the Vessels, or settling at the Bottom, and which.—12. If after an almost total Distillation or Evaporation of those Waters, some saline, fibrous, granulated, or otherwise figured Concretion, be made in the Liquor left, and exposed in a cold Place.—13. If the Water being all evaporated, or distilled dry, leaves a Settling, how much, and what Sort of Settling.—14. If the terrestrial Settling contains some Portion of Salt or not.—15. To which Salts, of those commonly known, the Salts of those Waters can have a Report.—16. If they precipitate into a red, or yellow Colour sublimate Mercury dissolved in common Water; and if they precipitate likewise, the sulphurous Earths of common Vitriol, as do the true Nitre of the Antients, the Natron of Egypt, the white Lode, and the fossil Borax.—17. If they change green the Colour of Syrup of Violets, and if they restore the blue Colour of the Tournesol, turned red by some alluminous vitriolick Acid or other, as the true Nitrates do.—18. If they turn red the Tournesol, as the Allum and Vitriol do.—19. If they thicken and coagulate quickly, the Liquor of the fixed Salt of Tartar, as does the succulent and second Portion of common Salt, which is not condensed but by a total Evaporation of the Water in which that Salt has been dissolved.—20. If they cause no Changes in the Waters of the Dissolutions of sublimate Mercury and Vitriol, nor on the Syrup of Violet, nor on the Liquor of the Salt of Tartar resolved, no more than do Saltpetre, and the first Portion of common Salt, which is crystalized when exposed in a cold or damp Place.—21. If the earthy Settlings of those Waters, after the Separation of their Salts, are entirely, or in Part dissoluble in distilled Vinegar, and with some Ebullition, as certain Sorts of Chalks, as does the white Earth of the Curds of nitrous and alkali Salts, produced by the Mixture of the second Portion of common Salt.—22. If those terrestrial Settlings divested of Salts, put to the Fire and strongly heated in German Crucibles, be fixed if they change Colour, if they are vitrified or calcined, and if by means of the reductive Salts, something metallick can be extracted from it or not.—23. And if their Salts purified, after they have been melted at the Fire, in Crucibles of a good vitrified Earth, assume some extraordinary Colour.

According to this Examen made on Waters of different Springs, both hot and cold, there may be observed particularly, Salts and Earth of divers Qualities, and in different Quantities.

The Salts condensed after a slow Distillation or Evaporation, may be reduced to two Genders, the one to the Nitre of the Antients, which is a sulphurous mineral Salt semblable to the Alkali of the Plants, the others to the common Salt considered in one, or the other of its different Portions, or according to the Mixture of both together. For in all the Analyses made of all Sorts of Mineral Waters, by the Academy of the Sciences at Paris, there has been found neither Allum nor true Vitriol.

All Mineral-Waters are either hot, or luke-warm, or cold; they also differ in the Taste, for some of them are sour or vinous, some auster or ferruginous, and others without any manifest Flavour, or insipid.

All those sensible Differences, joined to those which are the most remarkable in the settling of those Waters, after Distillation or Evaporation, and particularly in the Participation of certain Salts, some of which have some Report to common Salt, and others to the Nitre of the

Antients, have given Occasion to distribute Mineral-Waters into several Classes, to dispose in some Order the historical Details of the Observations made in examining them.

In the first of these Classes are the hot Waters, in which is found a Salt which has a Report to common Salt.

In the second are the hot Waters, whose Salt is found semblable to the Nitre of the Antients.

In the third are the insipid luke-warm Waters, which participate of some Salt, either common or nitrous, and some which have no Salt at all.

In the fourth, are the luke-warm Waters of a sourish or vinous Taste, which participate something of the true Nitre.

In the fifth, are the insipid cold Waters, which participate of some Salt semblable to common Salt, and some in whose Analysis no Salt is found.

In the sixth, are the cold Waters, whose Flavour is ferruginous or auster.

In the seventh, are the cold Waters of a sourish or vinous Taste, which participate of common Salt.

And in the eighth, are the cold Waters, of a sourish or vinous Taste likewise, which participate of the true Nitre.

Note, In the several Experiments which have been made on Mineral-Waters, none of the hot ones have been found sourish, and none of the insipid cold ones nitrous.

Note, also, That none have took so much Pains to examine the different Qualities of the several Kinds of Mineral-Waters, as the Royal Academy of Sciences at Paris has done. I'll give here an Account of all the curious Discoveries they have made in that Examen, particularly of those which are found in the Kingdom of France; since by the Report those Waters may have with others found any where else, one may easily judge of the Qualities of those Waters: But previously to it, I must speak of the most considerable Springs of Mineral-Waters found here in England, which are of the first Class, viz. hot.

The chief hot mineral Springs in England, are those near Wells in Somersetshire, and those others at Buxton and Matlock in Derbyshire; which latter however, are rather warm or tepid than hot.

In the City of Bath are four hot Baths; one triangular called the Cross Bath, from a Cross that formerly stood in the midst of it; the Heat of which is more gentle than the others, because it has fewer Springs. The second is the Hot Bath, which heretofore was much hotter than the rest, when it was not so large as it now is. The other two are the King's and Queen's Baths, divided only by a Wall; the last having no Springs, but receiving the Water from the King's Bath, which is about sixty Feet square, and has in the Middle of it many hot Springs, which render its healing Quality more effectual. Each of these is furnished with a Pump to throw out Water upon the Diseased, where it is required.

The English pretend, that these Waters abound with a mineral Sulphur; they are hot, as already observed, of a bluish Colour, and strong Scent, and send forth thin Vapours. They do not pass through the Body like most Mineral Waters, though if Salt be added they purge presently. On Settlement they afford a black Mud, which is used by way of Cataplasin in Aches, of more Service to some than the Waters themselves; the like they deposite on Distillation and no other.

Dr. Astruc found the Colour of the Salt drawn from the King's and Hot Bath, yellow; and that from the Cross-Bath, white; whence he concludes, that the Cross Bath has more Allum and Nitre than the hot, which, tho' it abounds more with Sulphur, I conclude hence that it is all Nitre and no Allum. The Cross-Bath is supposed to prey on Silver, and all of them on Iron, and none on Brass.

Note, That the Use of these Baths is found beneficial in Diseases of the Head, as Palfies, &c. in cutaneous Diseases, as Leprosies, &c. Obstructions and Compressions of the Bowels, the Scurvy and Stone, and in most

most Diseases of Women and Children. The Baths have performed many Cures, and are commonly used as a last Remedy in obstinate chronick Diseases; where they succeed well, if they agree with the Constitution of the Patient; but whether they will agree or not, one cannot be known without Trial.

The most considerable *Mineral-Waters* in the Kingdom of France, which are also hot, are those of *Bourbon Lancy*, in the *Bourbonnais*. The great Number of Springs, the Magnificence of the Baths, the Antiquity of the Buildings, and the Care our Kings have taken of their Re-establishment for a Century past, give those Waters some Prerogative to be the first considered in that Kingdom.

The Examen has been made of the Waters of the *Lymbo*, of the *Queen's Fountain*, of that of *Efcures*, and of that of *St. Leger*.

The Water of the great Well, call'd the *Lymbe*, is the hottest in its Source; it is limpid and without Taste. Slowly distilled, no Difference is found between what passes first, and what comes through at the latter End of the Operation. It leaves at the Bottom of the Curcubite about $\frac{1}{4}$ of a white and saline Sediment, of which is separated $\frac{1}{10}$ of Earth, and the $\frac{9}{10}$ are a pure Salt, of the Taste of common Salt, which is condensed into Grains of a cubick Figure, like the Sea Salt: This Water always remains limpid in the Curcubites during the Distillation.

To examine the Quality of those Salts by comparing them with common Salt, the Academy caused to be dissolved, separately, of the one and the other Salt, in four Times as much of common Water; then some of it was mixed in other common Water in which had been dissolved sublimate Mercury; and it was observed, that by the Mixture of the Salt of the Water of the *Lymbe*, neither Disturbance, nor Precipitation was made in the Water where the Sublimate had been dissolved, as none was made by the Mixture of common Salt. The same was observed in the Dissolution of Vitriol, which was disturbed neither by the Salt of the Water of the *Lymbe*, nor by common Salt. Those two Salts put separately on the Tincture of Indigo, changes not its blue Colour, as Allom, Vitriol, and all the other Acids do, which turn it red: But they have equally precipitated the Salt of Saturn also dissolved in common Water, and filtrated thro' the grey Paper.

Having thus compared the Salt of the Water of the *Lymbe* with the common Salt, and observed the Report of one to the other, they observed afterwards the Differences of that Salt of the Water of the *Lymbe*, from the Allom and Vitriol, as well by the Light and Taste, which found in them notable Differences, as by the Mixtures made separately of those three Matters dissolved in common Water on a Tincture of Indigo, the blue Colour whereof, which was changed into a clear Red by the Mixture of Allom, and into a brown Red by the Mixture of Vitriol, was not at all changed by the Salt of the Water of the *Lymbe*, nor by the common Salt.

By comparing that Salt of the Water of the *Lymbe* with the other mineral Salts vulgarly known, it was observed, that it did not fulminate in the Fire with combustible Matters as Salt-petre does; that the Savour of the one had no Report to that of the other; that Salt-petre dissolved in common Water changed a little the Tincture of Indigo into Red, which the Salt of the Water of the *Lymbe* did not; and that Salt-petre dissolved in common Water did not disturb the Dissolution of the Salt of Saturn, as the Salt of the Water of the *Lymbe* did.

It was also discovered, that the Salt of the Water of the *Lymbe* was different from the true Nitre, in that the true Nitre, such as the Natron of *Egypt*, and the natural Borax precipitates into an orange Colour the sublimate Mercury dissolved in common Water, what the Salt of the Water of the *Lymbe* did not, nor even disturbing that Dissolution of the Sublimate, as the Salt Gem does, which renders it a little milky.

By all these Comparisons of that Salt of the Water of the *Lymbe* with the other known Salts, it was observed, that it had no Report but to the Sea-Salt, and other such common Salts employed in preserving and seasoning Meat.

And because the Salt Gem and fixed Salt, separated from Saltpetre in refining it, appear semblable to the common Salt, they were both examined to see, to which of the two, the Salt of the Water of the *Lymbe* had more Report; and it was observed, that it was more semblable to the fix'd Salt of Saltpetre, than to the Salt Gem; and agrees likewise in that with common Salt. The Salt Gem dissolved in Water, and put to evaporate at a slow Heat, produces continually Crusts on the Surface of the Water, it disturbs and renders white the limpid Dissolution of Sublimate; it turns yellow the green Dissolution of German Vitriol, and in a short Time is condensed into transparent and long Fibres in that Dissolution of Vitriol, what the Salt of the Water of the *Lymbe* does not, no more than the common Salt, and the fixed Salt of Salt-petre.

Nothing bituminous and sulphurous has been discovered in the Water, nor in its Settlement.

The other Waters of *Bourbon Lancy*, which are those of the *Queen's Fountain*, and of the Fountains of *Efcures*, and of *St. Leger*, and which in their Sources have different Degrees of Heat, the first being the hottest, though less hot than that of the *Lymbe*; the second less than the first, and the third only warm or tepid, have been found to have the like Settlements, and in the like Proportion. All three had proportionably a little less Salt than that of the *Lymbe*; but otherwise their Salt was the same with that of the *Lymbe*; in five Pounds of those Waters there were almost a whole Drachm of Salt.

The Salt of those Waters melted, at the Fire, in German Crucibles, is only turned grey; and the Earth separated from the Salt of the Water of the *Lymbe* has changed Colour at the Fire, is turned very brown, and has contracted some Salt Taste; but that of the Waters of the other Springs has not changed.—These are the Remarks which have been made on the Water of the first Class, where has been discovered a Salt semblable to common Salt.

The hot Waters, in which is found a Salt semblable to the Nitre of the Antients, are, particularly, those of *Bourbon l'Archambault*, in the *Bourbonnais* likewise.

The Water of the Baths of *Bourbon l'Archambault*, taken in the Spring, was of a nitrous Taste.

During the Evaporation made at a slow Heat, to observe its Settlement, there were formed on its Surface white Pellicles, which were precipitated afterwards into Flakes: The whole dry Settlement was found to be $\frac{1}{10}$ of the Weight of the Water, and that Settlement contained $\frac{1}{10}$ of white Earth, and $\frac{9}{10}$ of Salt.

In examining that Salt it was observed that it had a lixivial Savour, and was purely nitrous. The Nitre to which Messieurs of the Academy have judged proper to refer the Salt of the Water of the Baths of *Bourbon l'Archambault*, is the true Nitre of the Antients, which has a Report to the sulphurous fixed Salt of burnt Plants, and is different from Salt-petre, which some Chymists mistake for the Nitre.—There is a fossil Nitre dug out of the Earth, into grey, compact, and pretty hard Masses. There is some soft, less compact, and pretty white, which blows on the Earth in some hot Climates: There are Waters impregnated therewith, as that of the Nile; the Natron of *Egypt*, and the natural Borax, are Species thereof.—All those nitrous Salts have some Sulphureity, which is not found in Salt-petre, unless it be alkalized, *i. e.* reduced by Means of the Sulphur of the Coals, to the Nature and Quality of the Salt of the Herb Kali, which is the black Sode. The sulphurous fix'd Salts of Plants, and the true Nitrates, cause the Dissolution of sublimate Mercury in common Water, to precipitate into an orange Colour; they turn that of the Syrup of Violets into green, and restore the blue Colour of Indigo, changed red by acid Liquors; what the Salt of the Waters of the Baths of *Bourbon l'Archambault* has done likewise, and which Salt-petre, common Salt, Vitriol, and Allom do not.

Nothing bituminous was found in that Water; and no other Sulphureity was discovered in it, but the nitrous one of its Salt: The Earth of its Settlement had nothing fat, and could be dissolved in Part in distilled Vinegar.

In four Pounds of that Water was found one Drachm and a half of nitrous Salt, and that Quantity of that Salt

was sufficient to purge by Stools as the Alkali do.

This great Quantity of true Nitre in the Water of the hot Springs of *Bourbon l'Archambault*, can be considered as the principal Cause of the Effects of that Water in those who drink it; and by the Consideration of the Properties of that Kind of Salt, which to warm, to attenuate, to resolve, to deterge, to purge, &c. one may judge of the Conveniency of that Water to the Constitution of the diseased Persons, and to the Quality of their Maladies, to prescribe them the Use thereof. The Properties of the Water of the Bath of *Bourbon l'Archambault*, are, in my Opinion, the same with those of the Water of the Baths in *England*, since the Salt in both is the same.

The third Class is that of the *insipid, warm, or tepid Waters*, some of which participate of some Sort of Salt, and the others have none.

Of this Kind of *Mineral-Waters*, is that of *Premeau* in *Burgundy*, which taken towards the End of the Summer, is limpid and without Savour, and pretty agreeable to drink. It has some deterfivè Quality.

To discover if that Water participates of some bituminous Matter, smelling like Amber, as it had been reported, Messrs. of the Academy, caused some of it to be distilled in Glass Alembicks, in *Balneo Mariæ*, which passed into the Recipients, had no Smell, and did not appear different from what had been put in Distillation: And nothing was found in the Settlement, having either Consistence, or Smell of Amber or of Bitumen.

They caused, likewise, some of the same Water to be evaporated in earthen Pans, at a slow Heat; but what was evaporated had no Smell. During the Evaporation, there were seen swimming in that Water some small Mucilages of a grey Colour; and toward the End of the Evaporation, the Surface of the Water was cover'd with a grey, and sandy Pellicle, and the Sides of the Pans lined with a subtile grey Salt. Towards the Bottom were the Mucilages which had nothing bituminous. These Mucilages being dried, dissolve themselves into a heavy Earth, and the whole Settlement, was but in a small Quantity, less than $\frac{1}{10}$ of the Weight of the Water.

In that Settlement there was a very small Quantity of Salt, of the Taste and Quality of common Salt. The Earth was not dissoluble in the Spirit of Vinegar. Being put in the Fire, and made red-hot, it turned white.

Among the *Mineral-Waters* of the fourth Class, which are the warm or tepid, of a sourish or vinous Taste, and which participate of the true Nitre, the Academy examined more particularly that of *Jaupe* in *Auvergne*, taken in the Spring, from the three Springs which flow there, which are the *small Spring* of *Jaupe*, that of the *Field of the Poor*, and that of *Beaurepaire*.

The Water of the small Source of *Jaupe*, was very limpid, and of a sourish and vinous Taste, leaving some dry Impression on the Tongue.

In emptying the Bottles to put that Water to evaporate, there were found at the Bottom some Settlements of the Colour of a dead Leaf, which were separated.

In the Evaporation, the Water did not appear thick or muddy, and there were formed in it neither Pellicles nor Flakes. What remained dry, made $\frac{1}{10}$ of the Weight of the Water. It was a greyish Matter almost half Salt, which had a Report to the true Nitre, and which being melted in a Crucible at a violent Heat assumed a red Colour.

The Earth of that Settlement was almost all dissolved in distill'd Vinegar, with a great Effervescence. It was not changed in the Fire.

The Water of the *Field of the Poor*, was in all Things semblable to that of the small Spring, its Settlements the same, and its Salt nitrous likewise.

That of *Beaurepaire* had nothing different from the two others.

The Salts of those three Waters, having been separately melted in Crucibles at a violent Heat, assumed a red Colour, more or less dark, according to the Degree of the Fire.

The Academy examining the Waters of the fifth Class (containing the insipid cold Waters which participate of

some Salt, semblable to common Salt, and some in which Settlements there is no Salt found) took a particular Notice of the *Fountain of Jonas*, at *Bourbon l'Archambault*. That Water, which had been taken in the Beginning of the Spring, was limpid, and without a manifest Taste.

That Water being evaporated, left only a very white and heavy Settlement, environ'd with some reddish Terrestriety. That Settlement had so little Salt, that it was not sensible to the Taste; and notwithstanding coagulated the Liquor of Salt of Tartar dissolved, as does the second Portion of the Sea-Salt.

That Earth could be dissolved in Part, in distill'd Vinegar, but was not changed at the Fire.

Among several Waters of the sixth Class, viz. the cold ones of a ferruginous and austere Taste, viz. the *Vabls* in *Dauphiné*, of a Spring called the *Dominick*, taken in the Month of *May*, appeared singular, and very different from other ferruginous Waters, having something vitriolick.

It was limpid and without Smell: Its Savour was vinous and styptick, like that of small white Wine, in which Vitriol had been dissolved. Its Stypticity was strong and disagreeable. It assumed a black Colour, inclining to blue, when mixed with Gall, much like the Water in which *English* Vitriol has been dissolved. It changed the Tincture of Indigo into a purple-red Colour, as does the same Vitriol; but being mixed with the Liquor of Salt of Tartar, no Precipitation happen'd, as it happens with Vitriol, and the whole Liquor turn'd very green. There was at the Bottom of the Bottles a small yellowish Settlement, such as is seen in Water where there is a ferruginous Vitriol.

Having put that Water in Alembicks, to have it distill'd at a slow Heat, so soon as it began to grow warm, it lost its former Savour, and was no more acid; but had only a ferruginous Taste. What began to distill was insipid, as well as what passed afterwards; and all that could be distilled was like pure Water. It remain'd but about $\frac{1}{10}$ of a grey Matter, which had some Report to Vitriol slightly calcined; it had its Taste but moderate. That saline Matter being dissolved in common Water, and mixed with the Liquor of Salt of Tartar, became as Ink with some Precipitation. The Vitriol causes no such Blackness with the Liquor of Salt of Tartar.

Those who have drank that Water of the Spring of the *Dominique* at *Vabls*, have found it heavy on the Stomach, and vomitive, that it purges downwards, and renders the Stools black.

Of the Waters of the seventh Class, which are cold, have a sourish or vinous Taste, and participate of common Salt, that of *St. Peter* of *Clermont* in *Auvergne*, taken in the Beginning of the Spring, was limpid, but had deposited in the Bottles some whitish Settlements. Its Savour was a little sourish and vinous.

During the Evaporation of that Water, Pellicles were formed on its Surface, which were precipitated into small Flakes. The whole dry Settlement amounted to $\frac{1}{10}$ of the Weight of the Water, and almost half Salt was extracted from it, semblable to that Portion of the Sea-Salt, which is crystalized at the Bottom in a damp Place, and which is mixed without Trouble with the Alkali, or sulphurous fixed Salts of Plants dissolved in common Water.

The Earth of that Settlement deprived of its Salt, as much as could be separated from it, by Means of hot Water, could be dissolved with a great Effervescence in Spirit of Vinegar. It contracted in the Fire a notable saline Taste, and its Whiteness turned grey.

The Water of *Pougues*, in the *Nivernois*, which is of the eighth Class, viz. cold, of a sourish or vinous Taste, and participates of a Salt, which has a Report to the Nitre of the Antients, taken in the Spring, was limpid, of an acid and disagreeable Taste.

In the Evaporation, its Surface was cover'd with white Pellicles, which fallen'd afterwards to the Sides of the Vessels, in Proportion as the Water diminished in evaporating. There remained, at last, a whitish and heavy Settlement, of a saline Taste, which amounted to $\frac{1}{10}$ of the Weight of the Water. Almost $\frac{1}{2}$ of Salt was extracted from it, which had the Qualities of true Nitre, discover'd by Experiments like those made

on the Salt of the hot Water of *Bourbon l'Archa-*
baud.

Note, That Messrs. of the Academy of the Sciences at *Paris*, made likewise a very curious Examen of the Spaw-Water, and as there is a vast Quantity of that Water imported into *England*, where it is much in Vogue, though perhaps of very little Service; I'll give in this Place the Discoveries those ingenious Gentlemen have made on that Water.

The Spaw-Water brought to *Paris* in Bottles, full and very well corked, was very limpid, of a fourish and vinous Taste. Mixed with Galls, it assumed a brown Colour.

That Water mixed with the Dissolution of sublimate Mercury, made in common Water, disturbed and rendered it milky; and mixed with Water, in which had been dissolved *German Vitriol*, it disturbed it likewise, and in a short Time happen'd a Precipitation of a subtile reddish Earth; which is done by Waters which contain a sulphurous Salt. The Acidity of that Water did not hinder it from disturbing and precipitating the Salt of *Saturn* dissolved in common Water: It changed but very little the Tincture of Indigo, which a lesser Acidity turn'd very red: Which makes one judge that the Acidity of that Water is not simple.

Having put that Water in Distillation at a very small Heat; in a Glass-Alembick very high, to separate from it what it has the most volatile and subtile, what passed first was not found different from what followed, and from what remain'd in the Cucurbite, in interrupting the Distillation, after about a fourth Part of it had been extracted, and it was no more acid. What remained in the Cucurbite having been put in an earthen Pan to evaporate slowly on hot Embers, to observe if some Concretion should happen during the Evaporation, that Water remained always limpid; and when there was left not above two Ounces of it in the Pan, new Essays were made to know the Quality of the Salt it contained, pouring a little of that Water, as well over the Dissolution of sublimate Mercury made in common Water, which is disturbed, as over that of *German Vitriol*, which it disturbed, likewise, precipitating a reddish Earth; and over the Syrup of Violets, which it changed green. All which Effects have been Proofs of a sulphurous Salt.

The Vessel in which the Evaporation was made, was found lined in its superior Part, towards the Edge, and all round, with a saline Concretion; and lower, towards the Bottom, it was lined with a yellowish Earth, almost insipid, but a little astringent.

The Evaporation ended, it remained of the whole Quantity of that Water, which was 7 Pounds, 6 Ounces, and 6 Drachms, an earthy and saline Settlement, which lined the whole inward Surface of the Pan. That Settlement being taken out, weighed only 48 Grains, three Quarters whereof were a light and subtile reddish Earth, and the other Quarter was a sulphurous Salt, which precipitated the sublimate Mercury into a whitish Colour, as do the volatile Salts of the Plants and Animals; and not into a red or orange Colour, as do the true Nitre, and the Alkali.

Note, That the great Quantity of *Mineral-Waters* the Physicians prescribe to their Patients for the Cure of certain rebellious Maladies, which cannot be conquer'd by ordinary Remedies, give Occasion to judge, that the Effect their Patients hope from it, is to cleanse the Viscera by that inward washing. That Effect is very considerable, because most of the chronick Maladies proceed from the Obstruction of the Viscera, which that great Quantity of Drink can resolve. The Relief which Patients receive from it, is the Cause that few Physicians take the Pains to seek after the particular Qualities of those Waters, which, notwithstanding are very different, and of that Consequence, to deserve our Attention, in order to make a better Use of it, according to the Differences of the Maladies, and of the divers Constitutions of the Patients.

It is easy to judge, that all Spring-Waters, such as the *Mineral*, which are employ'd in Medicine, can have

different Qualities, if one considers, that some of them come from Places less distant from the Surface of the Earth; and the others from deeper Places. Those which could not penetrate very deep, because of the Beds of Stone, or of Clay, which are underneath, remain on those Beds, and flow only through those Places where they find a Passage. They have their Origin, either from the falling of the Rain, or from the Transcolation of the Waters of Rivers, Lakes, or of the Sea through the nearest Grounds, and in those where they can extend themselves; and in running through those Grounds, they dissolve the Salts they meet with, and load themselves with some subtile terrestrial Particles, found in them in the Evaporation. The Water which comes from the deepest Places, where it has been carried by its own Weight, through the Places it could penetrate, cannot re-ascend in its liquid Consistence, without being forced; but being rarified by some subterraneous Heat, it rises into Vapours; then re-assuming its former and natural liquid Consistence, from the Cold towards the Surface of the Earth, it forms, in coming out, Fountains, and even Lakes on very high Mountains, where it can very well rise thus, since some of it rises as far as to the middle Region of the Air, where the Clouds are formed, and whence the Rain falls. Those Waters rarified in the Depths of the Earth, whence they arise, receive easily the Mixtures of the Exhalations, and *Mineral Vapours*, which are frequent in those Places; but those Mixtures being not very often discover'd in those Waters flowing from their Sources, neither by the Smell, nor by the Taste, cannot be known but by their Effects, the Report whereof to their Causes, is not always very easy and certain.

The Knowledge I give here of the Salts and Earths of several *Mineral-Waters*, will not satisfy plainly the Curiosity of those who would be informed likewise of the other Causes of the Properties of those Waters, since besides the Mixture of the concrete Matters found in them, according to the Observations related in this Treatise, there could be found, likewise, in them, Matters which are concrete, so subtile, and so volatile, that nothing can be discovered of them, in the Settlements, different from the Salts and the Earths, and which is no more found in what passes through Distillation. That fourish or vinous Taste, which vanishes when the Water is exposed to the Air, or to the Heat, must have for a Subject a very volatile spirituous Matter, which it would be very proper to know. The Heat which some of them have in their Sources, and at their fallying out of the Earth, can be attributed to hot Vapours mixed with them in their Course, in the subterraneous Depths where the cold Air cannot have a free Access; and certain particular Effects of those Waters, on divers Subjects, give occasion to judge that they are not pure and simple.

However, the Observations made on the Salts and Earths of those Waters can serve as well in Medicine, as in the mechanical Arts, to form a Judgment of the Conveniency of some of those Waters, for some Uses purpos'd.

The two Sorts of Salts, under which have been reduced those of these Waters, can have Differences which divide each of those Sorts into several others, as the Physicians of the Royal Academy have observed it in the Salts extracted from the Ashes of divers Plants, which they have found to have some Report to the true Nitre, and the other Salts to the common Salt, retaining the Participation of the specifick Properties of their Subjects.

Some of the Earths found with those Salts, in the Settlements of evaporated or distill'd *Mineral-Waters* may have, likewise, particular Uses according to their Differences. Some *Germans* have observed, that the white Earth of the *Mineral Water* of *Schwalbach* is purgative. They have had in the Academy some Bottles of that Water, whose Flavour was vinous and strong. The Salt of its Sediment was nitrous and precipitated into a nacarate Colour the sublimate Mercury dissolved in common Water, as do the Alkali of the Plants. The Earth separated from that Sediment was white like Chalk, but there was not enough to experience

rience its purgative Virtue. The true Nitre of the Antients being sulphurous, and having a Report to the Alkali of the Plants, has like them that purgative Faculty. And that white Earth found with the nitrous Salts of the *Mineral-Waters*, can participate of the same Quality, as the Chalk of the Salt of Tartar coagulated by the second Salt of Sea-Water, retains some Properties of its Salt, though it be insipid, and not dissoluble in Water, but only in acid Liquors, as is the distilled Vinegar, which dissolves it with Effervescence: Which has been observed, likewise, in several white Earths of the nitrous *Mineral-Waters*.

The vaporous Matter of the sourish and vinous *Mineral-Waters*, is very likely, the first Being of the mineral Sulphur, and of the Concretions which result from it. There are found Earths impregnated with that sulphurous and vitriolick *Mineral*. And often no concrete *Mineral* is formed of them, which could be discover'd in those Earths, where neither mineral Sulphur, Vitriol, nor Metal is found.

This vaporous and indigest mineral Matter, can very well be the Principle of Vitriol, but in its first State, it cannot be a vitriolick Product, if there be any found in Earths, where there is no Vitriol yet. It is more easy to observe it in its Products, when it has received some mineral Concretion. The humid Air penetrating the Stones of the Mine, which are insipid, but impregnated with a mineral Sulphur, which is easily felt, when disengaged by the Fire, renders manifest to the Taste, a sulphurous Acidity, which was not felt before. And of the concrete Sulphur of those Stones of the Mine, or Marcasites, penetrated with the humid Air, a concrete vitriolick Salt is formed, which is the Product of that mineral Sulphur, whose Principle was an acid and very vaporous Matter. Which has been observed in several argillous Earths exposed to the Air, which resolving themselves into Powder, contracted first an Acidity most sensible to the Nose, then to the Tongue; because there were formed in them sulphurous and inflammable Concretions, and afterwards saline Concretions, which were reduced into Vitriol.

This subtle, vaporous, and acid, or rather acerb Matter, does not produce always vitriolick Concretions; and it happens in several Earths, that for Want of the requisite Dispositions, it remains in its first State. Then it is not a Vapour of Vitriol; and the *Mineral-Waters* which run through the Earths where that subtle Matter is found, and which contract an Acidity by its Mixture, ought not to be called vitriolick. It has been observed in several Waters, impregnated with that acid Liquor, that they neither contained a true Vitriol, nor any Matter which had a Report to Allum, and that the Salt remaining in their Sediment was a Nitre, such as described by the Antients, and which is as different from Vitriol and Allum, as all the Alkali or sulphurous fixed Salts of the Plants.

The Salts, Vitriols, Allums, and other concrete Matters, resolvable in Water, can be mixed in *Mineral-Waters*, so as not to be discover'd but in their Settlement; but the Sulphurs and Bitumens are always easily discovered in the Waters impregnated therewith, because they reside in them, or swim a-top, it being impossible they could be mixed with them as the Salts are. Messrs. of the Academy, perceived none in the Waters sent them. Those which were very hot in their Source, did not appear more sulphurous and bituminous than the others; and if some Sulphur or Bitumen be found in their Basins, or in their Muds, it may be, that it is not such enflamed Matters in the Earth which have heated them. It is more likely, that they contract that Heat by the Mixture of some hot Vapours they meet with in the deep Places they pass through. For Experience informs us, that no combustible Matter takes Fire, or preserves it long, without Air; and that to extinguish the Fire in lighted Bitumens, there wants nothing else but to deprive them of the Communication of the Air, by covering the Vessels close which contain those Matters. The Sulphurs which burn in certain deep open Places of some Mountains, do not take Fire, but where they take Air, and when what was uncover'd is consumed, the Fire ceases in what is cover'd, though it be equally combustible.

And if some Matters take Fire strong enough not to be smother'd under Ground, it bursts what covers it, to gain more Room, and take Air, as that of Gun-powder does in Mines.

If there be no perpetual subterraneous Fires, the Heat of certain *Mineral-Waters*, which continue hot in their Sources, cannot be attributed to them. It is more likely, that there are in several Places of the Earth hot Vapours and Exhalations, the Heat whereof is preserved in deep and very close Places, where the Air does not penetrate to cool them; and where those rarified Matters have not Room enough to rarify themselves more, and receive some Abatement or Dissipation of their Heat, by a greater Rarification. But the Heat of those Vapours can be increased by forcing through their narrowest Conduits; and if they meet with Waters which run through the same Conduits, they may heat them, by mixing with them.

Some Experiments have been made, which give Room to judge, that the Waters of hot Springs and natural Baths, are heated by hot Vapours which pass along with them.

1. Because those hot *Mineral-Waters* do not burn the Mouth and the Tongue of those who drink them, as they flow from their Source, as would common Water heated at the Fire to the same Degree of Heat: Which seems to proceed from the Tenuity of the Matter which causes that Heat in the Water. The Flame of Spirit of Wine does not burn so violently the Hand it touches, as would do a red hot Coal.

2. Because the Heat of *Mineral-Waters*, does not act on certain tender Matters, as does that of common Water contracted at the Fire in the same Degree: For it has been seen that Sorrel-Leaves, which grow soft, very easily in common Water moderately heated on the Fire, do not grow soft in the *Mineral-Waters* of the *Nerii* in the *Bourbonese*, which are the hottest in France, and the Excess of the Heat thereof, renders difficult to be drank; but those Leaves only changed Colour, and became yellowish like dead Leaves. Which makes one judge that that Heat proceeds from some Vapour, or some Exhalation different from the Water, and more proper to dry than to soften.

3. Because those Waters are found hotter in their Springs at Night, than in Day-time; which may be caused by the Coolness of the Air; which hinders the Dissipation of the hot Vapours and Exhalations mixed in those Waters.

4. Because those Waters exposed to the Air out of their Sources, do not grow cold so soon, as does common Water heated at the Fire; because the cold Air, which soon stops the Motion excited in the common Water by the Fire, retains the hot Vapours which heat the *Mineral-Waters* by their Mixture, and hinders them from being so soon dissipated.

5. Because the hot *Mineral-Waters* have not a greater Disposition to boil on the Fire, than the common cold Water; for the one takes as much Time to boil as the other. Which shews very well that the Heat contracted by the *Mineral-Waters* in the Earth, does not proceed from the Motion of their Particles excited by some subterraneous Fire; for that Motion continued or increased by the Fire of a Chimney or Furnace, would make them boil sooner than those which are cold, and have not that Disposition by a Motion began. That Heat of the *Mineral-Waters* proceeds then from some hot Vapours or Exhalations mixed with them, and which the Fire expels from them, before they can boil on the Fire.

If there be in the Earth, without Fire, some Heat strong enough to heat the Waters of certain Springs, that Heat, which communicates itself to Waters which have been hot for some thousand Years past, and have, perhaps, always been hot, must, in order to be perpetuated, preserve itself in the deepest Places of the Earth, and the most distant from the Surface of its Globe, where the Air, wherewith it is environ'd, could weaken it by its Coldness, which seems to be the most excessive. According to that Supposition, the Difference of the Waters of hot, and of cold Springs, some of which have been found to deposite the same Sediments, and to have the same Sort of Salts, should proceed from that those Waters

A GENERAL TABLE OF THE FOUR SYSTEMS OF MUSIC

System of the Antient Greeks

MODERN SYSTEM

First Octave

Second Octave

Third Octave

Fourth Octave

Characters of the Systems of the Latins

Characters of St. Gregory

Letters of the Keys of Guido Aretin

Letters of the Modern System

Sharp Natural Flat Double Sharp Semibreve Minum Crotchet Quaver

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13. Fig. 14. Fig. 15. Fig. 16. Fig. 17. Fig. 18. Fig. 19. Fig. 20. Fig. 21. Fig. 22. Fig. 23. Fig. 24. Fig. 25. Fig. 26. Fig. 27. Fig. 28. Fig. 29. Fig. 30. Fig. 31. Fig. 32. Fig. 33. Fig. 34. Fig. 35. Fig. 36. Fig. 37. Fig. 38. Fig. 39. Fig. 40. Fig. 41. Fig. 42. Fig. 43. Fig. 44. Fig. 45. Fig. 46. Fig. 47. Fig. 48. Fig. 49. Fig. 50. Fig. 51. Fig. 52. Fig. 53. Fig. 54. Fig. 55. Fig. 56. Fig. 57. Fig. 58. Fig. 59. Fig. 60. Fig. 61. Fig. 62. Fig. 63. Fig. 64. Fig. 65. Fig. 66. Fig. 67. Fig. 68. Fig. 69. Fig. 70. Fig. 71. Fig. 72. Fig. 73. Fig. 74. Fig. 75. Fig. 76. Fig. 77. Fig. 78. Fig. 79. Fig. 80. Fig. 81. Fig. 82. Fig. 83. Fig. 84. Fig. 85. Fig. 86. Fig. 87. Fig. 88. Fig. 89. Fig. 90. Fig. 91. Fig. 92. Fig. 93. Fig. 94. Fig. 95. Fig. 96. Fig. 97. Fig. 98. Fig. 99. Fig. 100.

ters run in the Earth through Places more or less deep. We must observe, that the Waters which run on the Earth are cold, if they are not heated by the Sun; and we find not a very manifest Heat in the Parts of the Earth which are not very deep: Which gives occasion to judge, that whatever notable Heat there be in the Earth, it must be very deep in it.

It is not very easy to discover the Qualities of those Vapours or Exhalations, which are mixed in *Mineral-Waters*, and heat them. It does not seem necessary that they should be all bituminous or sulphurous, tho' some of them be such. At *Aix la Chapelle*, are seen Flowers of Sulphur, exalted against the Walls of the hot Springs which are there. And in the burning Spring of *Dauziné*, in *France*, a Flame is seen coming out with the Water, and which very likely was not Flame under Ground, where it had not Air enough to burn, and the Water which comes out along with it, is scarce heated by it. But in several other Springs of hot *Mineral-Waters*, nothing is seen either sulphurous or inflammable. There are many other Mines which are heated without taking Fire, and whose Vapours are mixed in the hot *Mineral-Waters*, but the Qualities thereof are no otherwise known but by the Effects they produce.

Messrs. of the Royal Academy of the Sciences, had no Occasion to observe the various Effects of the different Kinds of *Mineral-Waters* in different Uses. The Observations of the Effects of those Waters on those who drink them, or use them in Baths, Lotions, Embrocations, &c. are reserved to Physicians, who must know the particular Dispositions of those Persons, and the State of their Health altered or restored. As to their Uses in the mechanical Arts, it will be easy to observe what the one and the other of those Waters can do in the Maceration of Hemps, in the Whiteness of Linen, in the Dying of Wools and Silks, in Dressing Leathers, in Tempering Iron-Tools, in Boiling Pulses, in Watering Plants, &c.

As to the Observations of the divers Weights and Consistences of *Mineral-Waters*, they can be better made in the Places where they flow, where they are not yet alter'd neither in their Composition, nor in their Consistence, as they can be by their being transported and kept, having lost some Portion of the vaporous Matters mixed with them, and which made up their most subtle Consistence; either having contracted some Corruption which has render'd them thicker, and almost mucilagenous; or having deposited certain mineral Terrestrities, which render them less subtle, when they are imperceptibly mixed in them, and which most commonly are not left to separate, before those Waters are drank, which are judg'd more efficacious when they are new, than when kept.

The Means used by that illustrious Company to observe the Weight and Consistence of those Liquors, have been the *Araiometer*, and the composed Ballance.

Note, That the *Araiometer* is a small hollow Globe of

Glass, having at the Bottom a small Cavity to contain as much Quick-silver as is necessary to make that Globe to plunge into the Liquor. In its superior Parts is a small Tube or Pipe an Inch long; and at the Extremity of that Tube is a small Bason to receive the Weights which are to make it plunge into different Liquors, to a certain Mark made in the Middle of that Tube. By Means of this Instrument put into divers Liquors, it is discovered, not only if their Consistence be different, but likewise of how much is that Difference, by the Observation of the Weight of the Instrument, and of that which is put on the Bason to make it plunge equally into those divers Liquors.

The *composed Ballance*, is a common Ballance very moveable and very just, to one of the Basons whereof is suspended, with some Horse-Hairs, a Cylinder of Tin well polished, of about four Inches in Height, and as much of Diameter, that it may occupy in the Water the same Space, a Pint of Liquor *Paris Measure*, would occupy, and of such a Weight, that it may plunge in all Sorts of Waters. That Cylinder being put into the Water, whose Weight and Consistence is to be observed; in the other opposite Bason of the Ballance, is put as much Weight as is necessary to keep the two Basons in Equilibrio; and according to the Difference of the Weight requir'd for that Equilibrium in divers Waters, one judges of the Difference of their Consistence, and of their Weight in the like Quantity. And to know the Weight of that Quantity of Water occupied by the Cylinder, that of the Cylinder must be observed, and the Weight put in the opposite Bason, subtracted from it.—This may be practised on *Mineral-Waters*, taken in their Sources, and examined on the Spot.

Note also, That the like Observations can be made on common Waters, either for drinking or to prepare Victuals, that by the Knowledge of their Properties, one may be capable to judge how they can contribute to Health. Those Waters called common, being not pure and simple, can have divers Properties, acquired by the Diversity of the Mixtures made in them, either in the Air, or in the Earth. And tho' they participate in nothing of those Sorts of Minerals, which have a Report to the metallick Gender, and the Participation thereof gave us Occasion to call *Mineral* the Waters impregnated therewith, they have, notwithstanding, something mineral; for the Salts and Earths found always mixed with them are mineral Productions. And in most of the Waters sent to the Royal Academy for *Minerals*, nothing but Salt and Earth, in different Proportions, has been found. The more and the less of those Mixtures, make the Distinction between the Waters of that Kind, employed only in medicinal Uses; and of those for common Uses, the most subtle, less heavy, and less mixed, are esteemed the best.

MUSIC.

MUSIC (from *Musa*, Muse, the Muses being supposed to be the Inventors thereof) is a Science that teaches how Sounds, under certain Measures of Tune, and Time, may be produced, and so order'd or dispos'd, as either in Consonance or Succession, or both, they may raise agreeable Sensations.

MUSIC divides itself naturally into *speculative* and *practical*.

Speculative MUSIC, is that which consists in the Examination of the Nature, Properties, Effects, &c. of the Sounds, and in reasoning on them.

Practical MUSIC, is that which shews how the Knowledge acquired by the speculative Part is to be applied; or how Sounds in the Relations they bear to *Musick*, may be order'd, variously put together, in Suc-

cession, and Consonance, so as to answer the End. And this we call *the Art of Composition*, which is properly the practical Part of *Musick*.

The first Branch, which is the contemplative Part, divides itself into these two, *viz.* the Knowledge of the *Relations and Measures of Tunes*, and the *Doctrine of Time*.

The former is properly what the Antients called *Harmonica*, or the *Doctrine of Harmony in Sounds*, as containing an Explication of the Grounds, with the various Measures, and Degrees of the Agreement of Sounds, in Respect of their Tune.

The latter is what they call *Rhythmica*, because it treats of the Numbers of Sounds, or Notes with Respect to Time; containing an Explication of long and short,

of swift and slow, in the Succession of Sounds.

The second Branch of the *practical Part of Musick*, as naturally divides into two Parts, answering to the Parts of the first.

That corresponding to the Harmonica, the Antients called *Melopœia*, because it contains the Rules of making Songs, with respect to Time and Harmony of Sounds; though we have no Reason to think the Antients had any Thing like Composition in Parts.

That which answers to the Rhythmica they call *Rhythmopœia*, containing Rules for the Application of the Numbers and Time.

Note, That we find a great Diversity in the ancient Writers, as to the Nature, Office, Extent, Division, &c. of *Musick*.

Hermes Trismegistus defines *Musick* to be the Knowledge of the Order of all Things, which is also the Doctrine of the *Pythagorean School*, and of the *Platonists*, who teach that every Thing in the Universe is *Musick*. Agreeable to which wide Sense, some divide *Musick* into *divine* and *mundane*. *Divine Musick* is that respecting the Order and Harmony which obtains among the celestial Minds. *Mundane Musick*, is that which respects the Relation and Order of every Thing else in the Universe. Though *Plato* by *divine Musick*, understands that which exists in the divine Mind, *viz.* those archetypal Ideas of Order and Symmetry, according to which God formed all Things. And as this Order exists in the mundane Creatures, he calls it *mundane*. This last Species the Antients again sub-divided into four, *viz.* *elementary Musick*, or the Harmony of the Elements of Things. — *Celestial Musick*, or the *Musick of the Spheres*, comprehending the Order and Proportions in the Magnitudes, Distances and Motions of the heavenly Bodies, and the Harmony of the Sounds resulting from those Motions. — *Human Musick*, which consists chiefly in the Harmony of the Faculties of the human Soul, and its various Passions; and is also considered in the Proportion, Temperament, and mutual Dependence of the Parts of the Body. — Lastly, *Musick*, properly so called, which has for its Object Motion, considered as under certain regular Measures and Proportions, by which it affects the Senses in an agreeable Manner. Now as Motion belongs to Bodies, and as Sound is the Effect of Motion, and cannot be without it, but all Motion does not produce Sound; hence this last Branch of *Musick* became further sub-divided. Where the Motion is without Sound, or as it is only the Object of Sight, it was either called *musica orchestica*, or *saltatoria*, which contains the Rules for the regular Motions of Dancing. Or *musica hypocritica*, which respects the Motion and Gestures of the Pantomines. When the Motion is perceived only by the Ear, *i. e.* when Sound is the Object of *Musick*, there were three Species, *viz.* *Harmonica* which considers the Differences and Proportions with respect to grave and acute. *Rhythmica*, which regards the Proportion of the Sounds as to Time, or the Swiftness and Slowness of their Successions. And *Metrica*, which belongs properly to Poets, and regards the Art of making Verses.

Aristides, *Quintilianus*, *Bacchius*, and some other ancient Writers, define *Musick* the Knowledge of Singing, and of the Things belonging thereto; which they explain by the Motions of the Voice and Body; as if Singing consisted only in the different Tones of the Voice. The same *Aristides* considering *Musick* in the largest Sense of the Word, divides it into *contemplative* and *active*. The first, he says, is either *natural* or *artificial*. The *natural* is either *arithmetical*, which considers the Proportion of Numbers, or *physical*, which examines the Order of the Things of Nature. The *artificial* he divides as above, into *harmonica*, *rhythmica*, and *metrica*. The *active*, which is the Application of the *artificial*, is either enuntiative (as in Chanting), *organical* (or instrumental Performance), *adject* (for Voice and Singing), *hypocritical*, in the Motions of the Pantomines. To which some add *imitational*, though in Reality no more than a Species of the *organical*; in which Water is used for the production of a variety of Sound.

Porphyry makes another Division of *Musick*, taking it in the limited Sense, as having Motion both dumb and sonorous for its Object; and without distinguishing the speculative and practical, he makes its Parts these six, *viz.* *rhythmica*, for the Motions of Dancing; *metrica*, for the Cadence and Recitation; *organica* for the Practice of Instruments; *poetica*, for the Numbers and Feet of Verses; *hypocritica*, for the Gestures of the *Pantomimes*; and *harmonica*, for Singing.

Note, also, That from these different Divisions of *Musick* by the Antients, I'll re-ascend to my first Division of that divine Science and Art, into *speculative* and *practical*; and enter first into a very particular and exact Detail, of all that regards the *speculative* or *theoretical Part* of *Musick*, passing from thence to as exact a one, of the *practical Part*.

The *speculative* or *theoretical Musick*, has for Object the *Sound*, which in *Musick* denotes a Quality, in the several Agitations of the Air, considered as their Disposition, Measure, &c.

The principal Affection of *Sound*, whereby it is fitted to be the Object of *Musick*, is that whereby it is acute, or *high* and *grave*, or *low*.

This Difference depends on the Nature of the sonorous Body; the particular Figure and Quantity thereof; and even in some Cases, on the Part of the Body where it is struck, and is that which constitutes what we call different Tones.

The Cause of this Difference appears to be no other than the different Velocities of the Vibrations of the sounding Bodies. In Effect, the Tone of a *Sound* is found by abundance of Experiments, to depend on the Nature of those Vibrations, whose Difference we can conceive no otherwise than as having different Velocities: And since it is proved, that the small Vibrations of the same Chord are all performed in equal Time, and that the Tone of a *Sound*, which continues for some Time after the Stroke, is the same from first to last: It follows, that the Tone is necessarily collected with a certain Quantity of Time in making each Vibration, or each Wave; or that a certain Number of Vibrations or Waves, accomplished in a given Time, constitute a certain and determinate Tone. From this Principle are all the Phenomena's of Tune deduced.

From the same Principle arise what we call *Concords*, &c. which are nothing but the Result of frequent Unions and Coincidences of the Vibrations of two sonorous Bodies, and consequently of the Waves and undulating Motions of the Air occasioned thereby.

On the contrary, the Result of less frequent Coincidences of those Vibrations, is what we call a *Discord*.

Sounds are again distinguished into *long* and *short*, not with regard to the sonorous Bodies retaining a Motion once received, a longer, or a less Time, though gradually growing weaker; but to the Continuation of the Impulse of the efficient Cause on the sonorous Body, for a longer or a shorter Time, as in the Notes of a Violin, &c. which are made longer or shorter, by Strokes of a different Length or Quickness.

This Continuity is properly a Succession of several Sounds, or the Effect of several distinct Strokes, or repeated Impulses of the sonorous Body, so quick that we judge it one continued Sound; especially if it be continued in the same Degree of Strength: And hence arises the Doctrine of *Measure* and *Time*.

Another Distinction of *Sounds* is into simple and compound, and that two Ways. In the first, a *Sound* is said to be *compound*, when a Number of successive Vibrations of the sonorous Body, and the Air comes so fast upon the Ear, that we judge them the same continued *Sound*; as in the Phenomenon of the Circle of Fire, caused by putting the fired End of a Stick in a quick circular Motion; where supposing the End of the Stick in any Point of the Circle, the Idea we receive of it there, continues till the Impression is renewed by a sudden Return.

A *simple Sound* then, with regard to this Composition, should be the Effect of a single Vibration, or of so many Vibrations as are necessary to raise in us the Idea of *Sound*. In the second Sense of *Composition*, a *simple Sound* is the Product of one Voice, or one Instrument, &c.

A *compound Sound*, consists of the *Sounds* of several distinct Voices, or Instruments all united in the same individual Time and Measure of Duration, that is, all striking the Ear together, whatever the other Differences may be. But in this Sense again, there is a two-fold Composition, a natural and artificial one.

The natural Composition, is that proceeding from the manifold Reflections of the first *Sound* from adjacent Bodies, where the Reflections are not so sudden as to occasion Echo's, but are all in the same Tune with the first Note.

The artificial Composition, which alone comes under the Musician's Province, is that Mixture of several *Sounds*, which being made by Art, the ingredient *Sounds* are separable, and distinguishable from one another. In this Sense the distinct *Sounds* of several Voices or Instruments, or several Notes of the same Instrument, are called simple *Sounds*; in Contradistinction to the *compound* ones, wherein to answer the End of *Musick*, the Simple must have such an Agreement in all Relations, chiefly as to Acuteness and Gravity, as that the Ear may receive the Mixture with Pleasure.

Sounds are distinguished besides into *smooth* and *even*, or *rough* and *harsh*, also *clear* and *hoarse*; the Cause of which Differences depends on the Disposition and State of the sonorous Body, or the Circumstances of the Place; but the Ideas of the Differences must be sought from Observation.

Smooth and *rough Sounds*, depend principally on the sounding Body; of this we have a notable Instance of Strings that are uneven, and not of the same Dimension or Constitution throughout.

M. Perrault, to account for Roughness and Smoothness, maintains there is no such Thing as a simple *Sound*, but that the Sound of the same Chord or Bell, is a Compound of the *Sounds* of the several Parts of it; so that where the Parts are homogeneous, and the Dimensions or Figure uniform, there is always such a perfect Mixture and Union of all the *Sounds*, as makes one uniform and smooth Sound; contrary Conditions produce Harshness. In Effect, a Likeness of Parts and Figures makes an Uniformity of Vibrations, whereby a great Number of similar and coincident Motions conspire to fortify and improve each other, and unite for the more effectual producing of the same Effect.

This Account he confirms from the Phænomenon of a Bell, which differs in Tone according to the Part it is struck in; and yet strike it any where, there is a Motion over all the Parts. Hence he considers the Bell as composed of an infinite Number of Rings, which, according to their different Dimensions, have different Tones, as Chords of different Lengths have; and when struck, the Vibrations of the Parts immediately struck specify the Tone, being supported by a sufficient Number of consonant Tones in other Parts. This must be allowed, that every Note of a stringed Instrument is the Effect of several simple *Sounds*; for there is not only the *Sound* resulting from the Motion of the String, but that from the Motion of the Parts of the Instrument, which has a considerable Effect in the total Sound, as is evident from hence, that the same String on different Violins sounds very differently.

But M. Perrault affirms the same of every String in itself, and without considering the Instrument. Every Part of the String, he says, has its particular Vibrations different from the gross and sensible Vibrations of the whole; and these are the Causes of different Motions and *Sounds* in the Particles, which uniting, compose the whole *Sound* of the String, and make an uniform Composition, wherein the Tune of the particular Part struck prevails; and all the others mixed under a due Subordination with it, so as to make the Composition smooth and agreeable. If the Parts be unevenly or irregularly constituted, the *Sound* is harsh, which is the Case in what we call *false Strings*, and various other Bodies, which, for this Reason, have no certain and distinct Tone, but a Composition of several Tones, which do not unite and mix, so as to have one Predominant to specify the total Tone.

As to *clear* and *hoarse Sounds*, they depend on Circumstances which are accidental to the sonorous Body; thus a Voice or Instrument will be hollow and hoarse, if

raised within an empty Hogthead; that yet is clear and bright out of it: The Effect is owing to the Mixture of other and different *Sounds* raised by Reflection, which corrupt and change the Species of the primitive *Sound*.

For *Sounds* to be fit to obtain the End of *Musick*, they ought to be smooth and clear, especially the first, since without this they cannot have one certain and discernable Tone capable of being compared to others, in a certain Relation of Acuteness, of which the Ear may judge, and of Consequence can be no Part of the Object of Musick.

Upon the whole then, with M. Malcom; some call that an *harmonic*, or *musical Sound*, which being clear and even, is agreeable to the Ear, and gives a certain and discernable Tone (called *tunable Sound*) which is the Subject of the whole Theory of Harmony: But M. Sauveur, a Frenchman, calls by that Name such *Sounds* as always make a certain Number of Vibrations, in the Time that some other fundamental *Sound*, to which they are referred, makes one Vibration.

Harmonical Sounds, are produced by the Parts of Chords, &c. which vibrate a certain Number of Times while the whole Chord vibrates once. By this they are distinguished from the third, fifth, &c. where the Relations of the Vibrations are four to five, or five to six, or two to three.

The Relations of Sounds had only been considered in the Series of Numbers, 1 : 2, 2 : 3, 3 : 4, 4 : 5, &c. which produced the intervals, called *octave*, *fifth*, *fourth*, *third*, &c. M. Sauveur first considered them in the natural Series, 1, 2, 3, 4, &c. and examined the Relations of the *Sounds* arising therefrom. — The Result is, that the first Interval, 1 : 2, is an octave; the second, 1 : 3, a twelfth; the third, 1 : 4, a fifteenth, or double octave; the fourth, 1 : 5, a seventeenth; the fifth, 1 : 6, a nineteenth, &c.

This new Consideration of the Relations of *Sounds*, is more natural than the old one; and does express and represent the whole of *Musick*, and is in Effect all the *Musick* that Nature gives us without the Assistance of Art. — The String of an Harpsichord, or a Bell, besides their general *Sound*, which is proportionate to their Length, Tension, &c. do also at the same Time yield other subordinate and acuter *Sounds*, which a nice Ear, with a good Attention, clearly distinguishes.

These subordinate Sounds arise from the particular Vibrations of some of the Parts of the Strings, or Bell, which are as it were, detached from the rest, and make separate Vibrations: In Effect, every Half, every Third, every Fourth, &c. of the Chord, performs its Vibrations a-part, while a general Vibration is made of the whole Chord. Now all these subordinate Sounds are *harmonical*, with regard to the whole *Sound*; the least *Acute* which we hear is *octave* with the whole *Sound*; the least *Acute* that follows makes a *Twelfth* with the whole *Sound*; the next, a *Seventeenth*, &c. till they grow too acute for the Ear to perceive them. Now throughout the whole, we hear no such Thing as a *Sound* which makes a Fifth or a Third, &c. with regard to the whole *Sound*; none, in short, but what are comprized in the Series of *harmonical Sounds*.

Add, that if the Breath or Bellows that blow a Wind-Instrument, be played stronger and stronger, the one will be continually raised, but this only in the Ratio of the *harmonical Sounds*. So that it appears that Nature, when she makes as it were a System of *Musick* herself, uses no other but this Kind of Sounds; and yet they had hitherto remained unknown to the Musicians, not but that they frequently fell into them, but it was inadvertently, and without knowing what they did. M. Sauveur shews, that the Structure of the Organ depends entirely on this unknown Principle.

The Difference between two Sounds, in respect of *acute* and *grave*, or that imaginary Space terminated by two Sounds, differing in Acuteness or Gravity, is called *Interval*.

When two or more Sounds are compared in this Relation, they are either equal or unequal in the Degree of Time: Such as are equal are called *Unisons*, with regard to each other, as having one Tune; the other being at a Distance from each other, constitute what we call an *Interval* in *Musick*; which is properly, as we have

have already observed, the Distance in Tune between two Sounds.

Intervals are distinguished into *simple* and *compound*.

Simple INTERVAL, is that without Parts, or Division: Such are the *Octave*, and all that are within it; as the *second*, *third*, *fourth*, *fifth*, *sixth* and *seventh*, with their Varieties.

Compound INTERVAL, consists of several lesser *Intervals*; such are all those greater than the *Octave*; as the *ninth*, *tenth*, *eleventh*, *twelfth*; which Distinction of *Intervals* is clearly seen, at one View, in the following Table:

| | | | | | | | |
|----|-----|----|----|----|----|----|-------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | <i>Simple.</i> |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | <i>Double.</i> |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 | <i>Triple.</i> |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 | <i>Quadruple.</i> |
| 29 | &c. | | | | | | |

Those of the upper Rank mark the *simple Intervals*; and the other three, the *compound* ones, viz. either *double*, as those of the second Rank; or *triple*, as those of the third Rank; or *quadruple*, as those of the fourth Rank, &c.

To reduce at once a *compound* to a *simple Interval*, there's nothing else to do, but to take 7 off the Number which gives it the Name; if nothing remains, the *seventh* will be the *simple Interval*; if something remains, the Figure left will be the Name of the *simple Interval*. As for Example, if one will know what is a *thirteenth*, he must take off 7 from the Number 13, and there remains 6; a *thirteenth* therefore is properly a 6th doubled. Or if we want to know what is a *twenty-sixth*, we must take off three times 7, or 21, and there remains 5, the 26th therefore is a 5th Quadrupled. All *compound Intervals* are always reputed of the same Nature with the *simple*, which answer to it.

Of the twenty-nine *Intervals* which compose our Table, some are called by the *Italians*, *Consonanti*, *Consonants*; others *Dissonanti*, *Dissonants*.

The *Consonanti*, or *CONSONANTS*, are all the *Intervals* which please the Ear, whether they be perfect, as the *Octave*, and the *fifth*; or imperfect, as the *sixth* and *third*.

Dr. Holder, on this Principle, defines *Consonancy*, a Passage of several tunable Sounds, through the Medium, frequently mixing and uniting in their undilated Motions, caused by the well-proportion'd commensurate Vibrations of the sonorous Bodies, and consequently arriving smooth and sweet, and pleasant to the Ear.

The *Dissonanti*, or *DISSONANCE*, is in general a false *Consonance*, or Concord. A *Dissonance* is properly the Result of a Mixture, or Meeting of two Sounds, which are disagreeable to the Ear; and the Epithet given to all the *superfluous* or *diminish'd Intervals*, as the *Ditones*, *Tritones*, *false fifth*, *redundant fourth*, *seventh*, &c. *Dissonances* are used in *Musick*, and have a good Effect therein, though it be only by Accident.

Others they call *vitiati*, or *prohibiti*, i. e. *forbidden*, or which are never to be made in the Sequel of a Piece of *Musick*, through the Difficulty of tuning them one after another, either in *ascending* or *descending*. Such are, for Example, the *sixth Major*, the *Tritone*, the *fifth*, and all the other *superfluous Intervals*, the *seventh*, the *ninth*, or all those which are at so great a Distance, that the Voice cannot naturally reach it. Some are *forbidden* in *ascending*, and *permitted* in *descending*, such are the *fourth*, the *fifth*, the *seventh* diminished, &c.

Note, That the Antients were extremely divided about the Manner of measuring *Intervals*. *Pythagoras* and his Followers, measured them by the Ratio's of Numbers. They supposed the Differences of Gravity and Acuteness, to depend on the different Velocities of the Motion, which causes Sounds, and therefore concluded, that they could only be accurately measured by the Ratio's of those Velocities. Which Ratio's are said to be first invelligated by *Pythagoras*, on Occasion of his passing by a Smith's Shop, and observing a Concordance betwixt the Sounds of Hammers striking on the Anvil.

Aristoxenes opposed this; he thought Reason and Mathematicks had nothing to do in the Case, and that Sense was the only Judge in the Dispute; the other being too subtle to be of any Use. He therefore determined the *Octave*, *fifth*, and *fourth*, which are the most simple Concords, by the Ear; and by the Difference of the fourth and fifth, he found out the *Tone*, which once settled as an *Interval*, the Ear could judge of, he pretended to measure every *Interval* by various Additions and Subtractions made of these mentioned one with another: But this is very inaccurate.

Ptolemy keeps a middle Course between the two. He finds Fault with the one for despising Reason, and with the other for excluding Sense; and shews how these two may mutually assist each other in this Matter.

A *Compound Interval*; or an *Interval* composed of several lesser, is called *SYSTEM*, in *Musick*; such is the *Octave*, &c. The Word is borrowed from the Antients, who called a simple *Interval* *Dyastem*, and a compound one *System*.

As there is not any *Interval* in the Nature of Things; so we can conceive any given *Interval*, as composed of, or equal to the Sum of several others. This Division of *Intervals*, therefore, only relates to Practice; so that a *System* is properly an *Interval* which is actually divided in Practice, and where along with the Extremes, we conceive always some intermediate Terms.

The Nature of a *System* will appear plain, by conceiving it as an *Interval* whose Terms are in Practice, taken either in immediate Successions, or the Sound is made to rise and fall, from the one to the other, by touching some intermediate Degrees: So that the whole is a *System* or Composition of all the *Intervals* between one Extreme and the other.

System of the same Magnitude, and consequently of the same Degree of Concord and Discord, may yet differ in Respect of their Composition; as containing, and being actually divided into more, or fewer *Intervals*: And when they are equal in that Respect, the Parts may differ in Magnitude. Lastly, when they consist of the same Parts, or lesser *Intervals*, they may differ as to the Order and Disposition thereof between the two Extremes.

There are several Distinctions of *Systems*; the most remarkable is into *Concinnous* and *Inconcinnous*.

Concinnous SYSTEMS, are those consisting of such Parts as are fit for *Musick*; and those Parts placed in such an Order between the Extremes, as that the Succession of Sounds, from one Effect to the other, may have a good Effect.

Inconcinnous SYSTEMS, are those where the simple *Intervals* are *inconcinnous*, or ill disposed betwixt the Extremes.

Systems, again, are either *particular* or *universal*.

Particular SYSTEMS (at least called so by the Antients) were a *Compound* at least of two *Dyastems*, or *Intervals*, and consequently of three Sounds at least; such as all Kinds of *Thirds*; and more all the *Compounds* of three, four, five, &c. *Dyastems* or *Intervals*, such as are the *fourth*, *fifth*, *sixth*, and *octave*.

Whence *Boetius* calls the *Modes* or *Tones*, *Constitutions* or *Systems*; since in Effect a *Mode* is properly an Assemblage of several Sounds, of several *Intervals*, and of several particular *Systems*, which constitute a whole, called *Melody* or *Song*.

Hence we commonly call *General SYSTEM*, a *Gammut*, a *Scale*, an Assemblage of several Words, Syllables, Letters, Figures, &c. which serve to denote the Grave, and acute Sounds, their Differences, *Intervals*, Proportions, &c. so that *System* and *Gammut* are very near the same Thing in *Musick*, *Alphabets* are in Grammar; and as there have been different Alphabets, according to the Diversity of Languages, Times, Places, &c. there have been likewise several *Systems* of Sounds.

The first, or at least the most ancient we have Knowledge of, is that of the Greeks, which began at first by a *Tetrachord*, i. e. a Sequel, of four Chords only, the lowest whereof answer'd to our *mi*, and the two others to the Notes *fa*, *sol*, *la*, which is what *Ptolemy* calls the Order or *System* of *Mercury*, to which

the Invention thereof is attributed about the Year of the World 2000.

It was soon perceived, that that *Tetrachord* was not sufficient to express all the Sounds; therefore several Persons added, at different Times, three other Chords underneath the four above, which answer'd to what we call, at present, *si*, *ut*, *re*, and which formed with them two *Tetrachords*, but two *Tetrachords* joined; since the *mi* served as highest Chord to the first or lowest; and of the lowest Chord to the highest, as in the following Example:

Mi fa sol la
Si ut re mi.

Sometime afterwards, *Pythagoras*, according to the most common Opinion, having established Rules to find the Proportion of Sounds, perceived soon, that the two Extremes of those two *Tetrachords*, viz. *si*, and *la*, making the Interval of a seventh were *Dissonants*, which obliged him to add underneath the most grave Chord of those two *Tetrachords* an eighth Chord which made the *Octave* with the highest, viz. *la*, whence it was called *Proslambanomenos*, or added.

Lastly, as in Process of Time, it was found that those eight Sounds were not sufficient to express all the Sounds of the human Voice, several Persons added, by Degrees, other Chords, enough to form, besides, two other *Tetrachords* joined together, the Sounds whereof were an *Octave* higher, than the Sounds of the two first; thus the System was found composed of fifteen Chords, or four *Tetrachords*, the two Extremes whereof made between themselves the *Disdiapason* or double *Octave*; of which, to please the Curious, I give in the following Tables, the Order, Proportions, with the Name given them in the modern System.

TABLE of the fifteen DIATONICK CHORDS of the SYSTEM of the Antients.

TETRACHORD of the most ACUTE, or HIGHEST.

| | | | |
|--|----|----|-------------|
| The last of the most excellent, or most acute. | — | LA | Tone Minor. |
| The Penultime of the Excellents. | | | Key of SOL. |
| The third of the Excellents. | FA | | Semi Tone. |

TETRACHORD of the DISJOINED.

| | | |
|---------------------------------|------------|-------------|
| The last of the Disjoined. | MI | Tone Minor. |
| The Penultime of the Disjoined. | RE | Tone Major. |
| The third of the Disjoined. | Key of UT. | Semi Tone. |
| Paramese. | — | SI |
| | | Tone Major. |

TRITE SYNEMENON.

It is now the *Si mi*

TETRACHORD of the MESE.

| | | | |
|-----------------|-----------|-----|-------------|
| MESE | — | LA | Tone Minor. |
| MESON-DIATONOS | | SOL | Tone Major. |
| PARHYPATO-MESON | Key of FA | | Semi-Tone. |

TETRACHORD of the PRINCIPALS.

| | | |
|-------------------|--------|-------------|
| HEPATEMESON | MI | Tone Minor. |
| HYPATON-DIATONOS | RE | Tone Major. |
| PARHYPAME-HYPATON | UT | Semi-Tone. |
| HYPATE-HYPATON | SI | |
| PROSLAMBANOMENOS | LA LA. | |

For the Intelligence of this Table, it must be observed, 1. That as the *Proslambanomenos*, or added, does not contribute towards forming the first or lowest of the four *Tetrachords*, it is separated from it, and was added only to perfect the lowest *Octave*, and make the *Mese* the Middle of that System, according to its Signification, and to join so well the two *Octaves* which compose that said System, that it be the highest Chord of the lowest *Octave*; and the lowest Chord of the highest *Octave*, according to *Boetius's* Observation.

2. That between the two lowest Chords of each *Tetrachord*, i. e. between *mi*, *fa*, and *si*, *ut*, there is an Interval of five Comma's, or of a *Semi-Tone Major*; that between the two highest, as *re*, *mi*, and *sol*, *la*, there is a *Tone Minor*; and between those which make the middle, such as *ut*, *re*, and *fa*, *sol*, there is a *Tone Major*, at least in the Opinion of the Antients.

3. That to discover better the Conjunction of the

Tetrachords, I have on Purpose redoubled the *mi* of the two *Octaves*, where that Conjunction is made, so that the first terminates above the lowest of the joined *Tetrachords*, and the second, which notwithstanding is but the Emission of the first, begins under the highest of those *Tetrachords*. This the Antients called the greatest of all Systems, the immutable System, *Diatonick*, *Pythagorical*, &c.

Thus far, in fact, the System is purely *Diatonick*, is composed only of *Major Tones* and *Semi Tones*; which Nature alone, without the Assistance of Art, teaches the most ignorant how to tune, provided they have the Ear, and the Organs of the Voice well disposed. But as it was observed, in Process of Time, that between the *Mese* and the *Paramese* there was a full Tone, which render'd the fourth from *fa* to *si* superfluous, and very disagreeable, a fifth *Tetrachord* was invented to make full a middle Chord, to divide the Interval from the *Mese* to the *Paramese*, into two *Semi-Tones*, one *Major*, and the other *Minor*, called at present *si b*, and which has been marked since by a *b mol*.

This, without doubt, gave Occasion to *Timothy the Milesian*, to divide likewise in two Intervals *ut re*, and *fa sol*, which make the Middle of each *Tetrachord*, and a *Tone Major*, and that by Means of a double *Diezes*, which has been the Origin of the chromatick Gender; and has been the Cause that those Sounds or Chords, have been called moveable Sounds. But he did not divide in the same Manner the Intervals *re mi* and *sol la*, which terminate above each *Tetrachord*, because they make but one *Tone Minor*; whence they are called stable Sounds or Chords.

Lastly, one *Olympius*, refining on that Division, pretended, that at the Example of the *Tones Major*, the *Semi Tones Major* should also be divided in two; which engaged him to put 1. A middle Chord, between the two lowest Chords of each *Tetrachord*, viz. betwixt *si ut*. and *mi fa*. And 2. Another middle Chord, betwixt the second *Diatonick* Chord of each *Tetrachord*, and the *Chromatick* Chord, which was a *Semi-Tone* higher than the *Diatonick*; which was the Origin of the *Enharmonic* Gender, and consequently of the *Enharmonic* and *Chromatick* *Diezes*.

Note, That the *Enharmonic* is one of the three Genders of *Musick*, in which the Modulation proceeds by little Intervals less than the *Semi-Tone*, i. e. by *Quarters of Tones*; therefore it has two *Diezes* or Signs to raise the Voice, which are peculiar to it, viz. the *Diezes* *Enharmonic* Minor, marked by a Cross thus +; and the *Major*, or triple *Diezes* marked by a triple Cross thus X. This Gender was antiently much in Use in the *Musick* of the *Greeks*, especially for the *Dramatick*, or *Recitative* *Musick*; but as those almost insensible Elevations of the Voice are of a too great Difficulty, and would, besides, render often the Accords false; hence the Use thereof is lost; what Efforts soever have been made, from Time to Time, by illustrious Authors to revive it.

Therefore having gathered those three Genders into a single System, each *Tetrachord* was composed 1. Of four *Diatonick* Chords, such are, for Example, *si*, *ut*, *re*, *mi*. 2. Of one *Chromatick* Chord, which was a *Semi-Tone* above the *ut*, called at present *ut Diezis*. 3. Of two *Enharmonic* Chords, the first whereof divided the *Semi-Tone* from the natural *ut*, to the *ut Diezis*, into four Quarters of a *Tone*. With Regard to the Intervals from the *ut Diezis* to *re*, and from *re* to *mi*, they were not divided in the antient System, because they were thought then *Minor Intervals*, incapable therefore of that Division.

There is to be seen in our Plate of *Musick*, fig. 1. an Example thereof by the common Notes of *Musick*, where the four white Notes are *Diatonick*; the two first black, *Enharmonic*; and the third black and square *Chromatick*.

I have put there but one of the *Tetrachords*, because we must speak of the others in Proportion.

This was the Disposition of the *Tyra*, or antient System of the *Greeks*. But as the Names of all those Chords were too long to be written under the Syllables of the Text, they substituted in their Place certain Letters

ters of their Alphabet, sometimes upright, and sometimes laying, and sometimes upside-down, &c. but it must be observed, that they were contented with placing those Characters on the same Line immediately above each Syllable of the Text.

In Process of Time the *Latins* finding that those Characters, either by reason of the Variety and Extravagance of their Figures, or because of their Multitude (which, according to some Authors, amounted to 1240) were too difficult to retain, or remember, substituted in their Place, the first fifteen Letters of their Alphabet, viz. A, B, C, D, E, F, G, H, I, K, L, M, N, O, P. which formed as a *second System*, which notwithstanding differed in nothing from the former but in the Number of Figures.

Some Time afterwards Pope St. Gregory, according to Gaffurius and Kircher, having observed that the Letters H I K, &c. were properly nothing else but a Repetition of a higher Octave of the first seven Sounds, A, B, C, D, &c. reduced all the Characters of the Sounds to the first seven Letters of the Alphabet, which were repeated more or less, either high or low, according to the Extent of the Voices, Instruments, &c. but then they contented themselves still with marking them, as the *Greeks* used to do, above each Syllable of the Texts, which were to be sung, and always on the same Line.

But in the eleventh Century, about the Year 1024, according to Baronius, Guido Aretin, a Benedictine Monk, born in the City of Arezzo in Tuscany, invented a third System, for which the two preceding ones were soon abandoned, and this universally received, having served besides for Foundation to the modern one.

This Author then, having observed, 1. That the Names the Antients gave to the Chords of their System were too long, substituted in their Place he six famous Syllables, *ut, re, mi, fa, sol, la*, which came into his Mind, by a Kind of Inspiration, in singing the first Stroph of the Hymn of St. John Baptist, in which, as is plainly seen in this Place, they are in fact included thus:

| | |
|-----------------|------------------|
| UT queant laxis | RE sonare fibris |
| Mira gestorum | FAMULI tuorum |
| Solve polluti | LABII reatum |
| Sancte Joannes. | |

Which Angelo Bernardi, an Italian, has ingeniously included in the following Verse:

UT RElevet MISerum FATum SOLitoſque LABores.

2. The Shortness of those Monosyllables could very well have procured them the Means of writing them with great Facility above each Syllable of the Text, as it had been practised till then. But finding, and with Reason, that such a Manner of writing the Notes or Sounds on the same Line, could not make a sufficient Distinction of the grave Sounds from the acute, and consequently help enough the Memory, nor Imagination, he introduced the Use of several parallel Lines, on which, and between which, he placed certain round or square Points, immediately above each Syllable of the Text, called since Notes, and which by the high or low Situation of the Degrees they occupied on, or betwixt those Lines, made at once the Distinction of the grave Sounds from the acute.

Note, That those horizontal Lines, on which, and between which, the Notes are placed at present, were, before Guido Aretin, as many as the Extent of a Tune or Song contained different Sounds, because then the Points which marked the Sounds were placed on the Lines only; but afterwards, those Points were placed likewise in the Spaces betwixt those Lines, and the Number of those Lines reduced to four, which made 9 Degrees to place 9 different Sounds, the Songs of those Times having seldom a greater Extent. But as a greater one was given to them afterwards, the Number of those Lines was increased to five (the lowest of which is always the first, and the highest the fifth) which make eleven Degrees, the two Spaces underneath, and a top those five Lines included; with Leave to add to them some other small Lines, if those Degrees be not sufficient to express all the

Sounds of a Melody or Song.

3. But to mark more precisely which Sound each of those Points represented, he took the first six Letters of the *Latins*, a-top of which he placed the F or Gamma of the *Greeks* (to mark in the Opinion of some Authors, that Musick, at least the Art of noting it, come from those People, or according to others, because his Name beginning with a G, he was glad to inform Posterity that he was the Inventor of that new Method) he named those Letters Keys, because they were to serve to open, or give the Knowledge of the Sounds, and having joined them with those six Syllables, *ut, re, mi, fa, &c.* he formed a Table of them, Part whereof may be seen in our Plate of Miscellany, fig. 1. and which has been called ever since Gamma or Gamut, because of the Addition of the Gamma of the *Greeks*, and Scale for its Figure.

4. It is probable enough that he placed, first, at the Head of each Line, and between each of them, one of those seven Letters or Keys, which marked the Name to be given to all the Points or Notes, found on or betwixt those Lines, as fig. 2. in our Plate of Musick.

Fa mi fa re ut re la fa la re ut re mi fa mi re.

Therefore it is easy to see that the first, 3d and 14th Notes are called *fa*, because they are on one Line marked with the Letter F; the second, 13th and 15th, must be called *mi*, because they are in a Space marked with the Letter E, and thus of the others: But it is not less probable, that in Process of Time he contented himself with marking the Letters of each Line, without marking those of the Spaces, as several Examples of it are seen yet in antient Manuscripts. They contented themselves afterwards to mark only one of those 7 Keys at the Beginning of the Lines, because by the natural Order they have between themselves, so soon as one is sure that on a Line there is, for Example, a *fa*, it is easy to know that on the Degree above it there is a *sol*, and under it a *mi*, and thus successively of the others, &c. Lastly, of those seven Letters, or Keys, three have been chosen, viz. that of G, that of C, and that of F, called Claves signatæ, or marked Keys, because it suffices to put one of them at the Beginning of the Lines to give the Intelligence of all the others: Each Key giving the Opening for the Name of the Notes, for the Quality of their Sound, and for the Sorts of Voices which are to sing them. When immediately after there are several *bb*, or several *xx* they are called transposed Keys, and when there is nothing natural.

Note, That though the Key be not transposed, through the Negligence and Forgetfulness of placing to it the Diezes or *b-mols*, the Piece is notwithstanding sometimes transposed, by the accidental Diezes or *b-mols*, found before certain Notes in the Course of the Piece, and which should have been placed at the Key.

Note, also, That to give a more distinct Notion of the Key, we must observe, that the Octave contains in it the whole Principle of Musick, both with respect to Consonance or Harmony, and Succession or Melody; and if either Scale be continued to a double Octave, there will in that Case be seven different Orders of the Degrees of an Octave, proceeding from the seven different Letters with which the Terms of the Scale are marked. Any given Sound therefore, i. e. a Sound of any determinate Pitch or Tune, may be made the Key of the Piece, by applying to it the seven natural Notes arising from the Division of an Octave, and repeating the Octave above and below at Pleasure. The given Note is applied as the principal Note or Key of the Piece, by making frequent Closes or Cadences upon it; and in the Progress of the Melody, no other but those seven natural Notes are to be admitted, while the Piece continues in that Key, every other Note being foreign to the fundamental or the natural. For Instance, suppose a Song begun in any Note, and carried on upwards or downwards, by Degrees and harmonical Distances, so as never to touch any Notes, but what are referable to that first Note as a fundamental, i. e. are the true Notes of the natural Scale proceeding from the fundamental; and let the Melody be so conducted through those natural Notes, as to close and terminate in the fundamental, or any

Gammut, or Guido's Scale.

| | B dur | nat. | molle |
|----------------|-------|------|-------|
| cc | la | mi | la |
| dd | sol | re | sol |
| cc | fa | ut | fa |
| bb | mi | | mi |
| bb | re | la | re |
| aa | ut | sol | ut |
| G ⁺ | la | mi | |
| f | sol | re | la |
| d | fa | ut | sol |
| c | mi | | fa |
| b | re | la | mi |
| a | ut | sol | re |
| G | fa | ut | |
| F | la | mi | |
| E | sol | re | |
| D | fa | ut | |
| C | mi | | |
| B | re | | |
| A | ut | | |

Fig. 15.

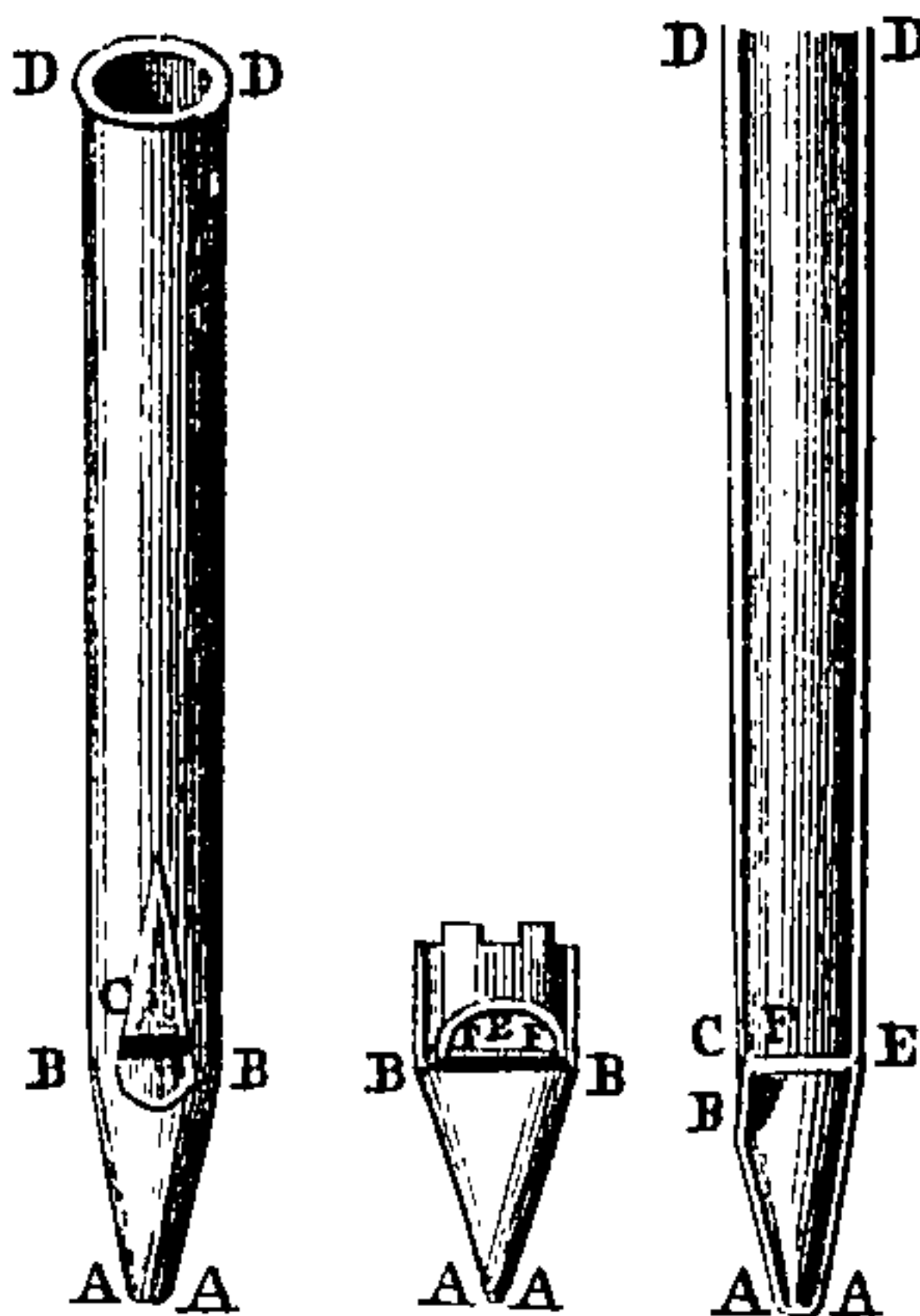
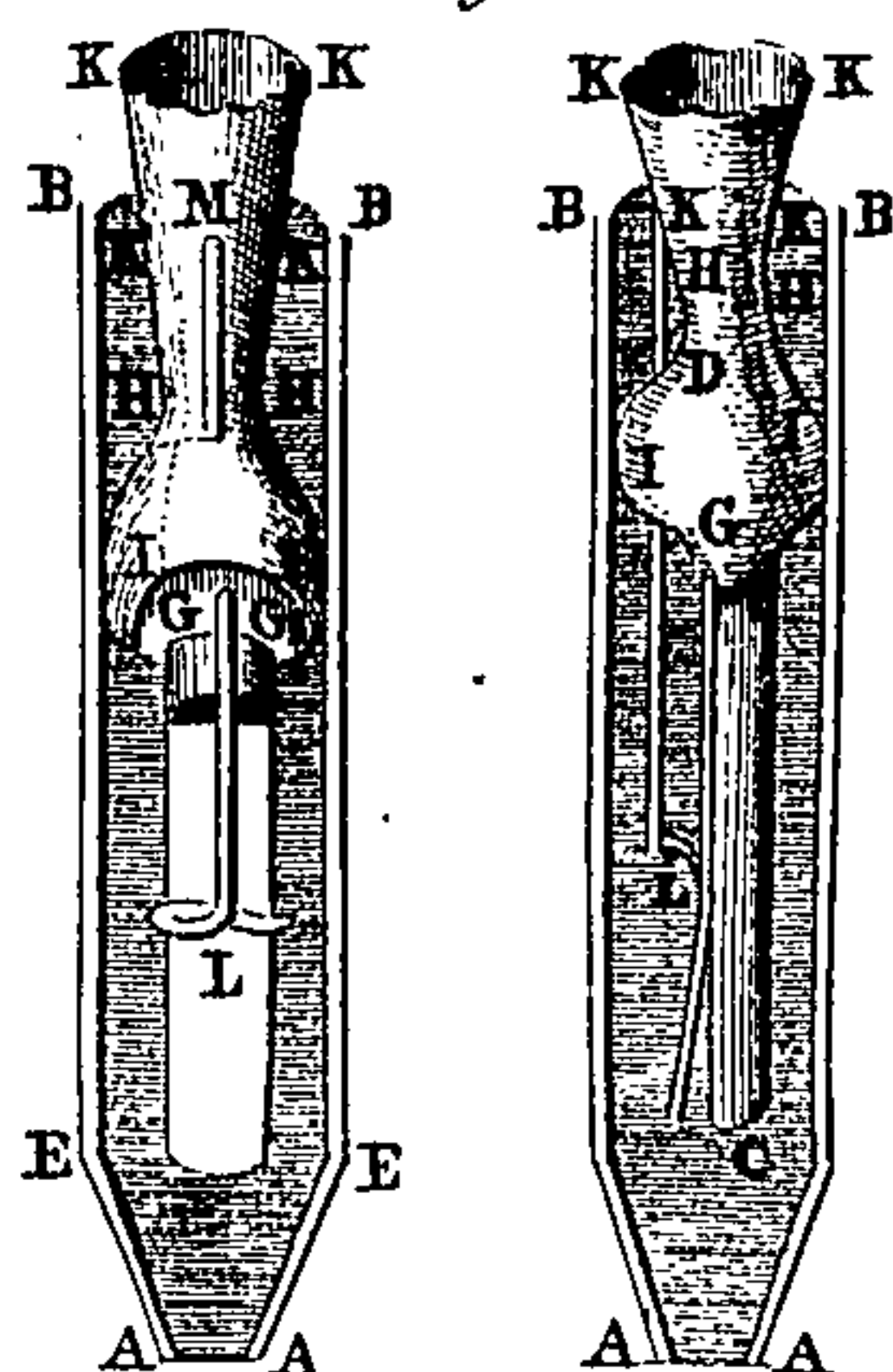


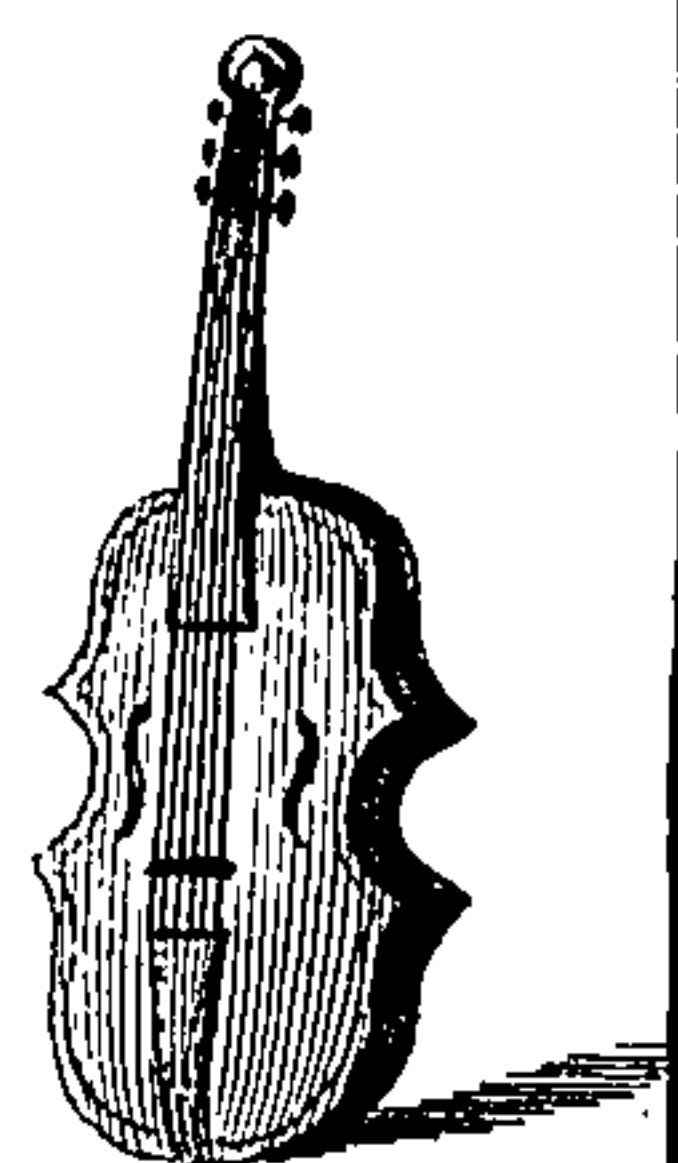
Fig. 16.



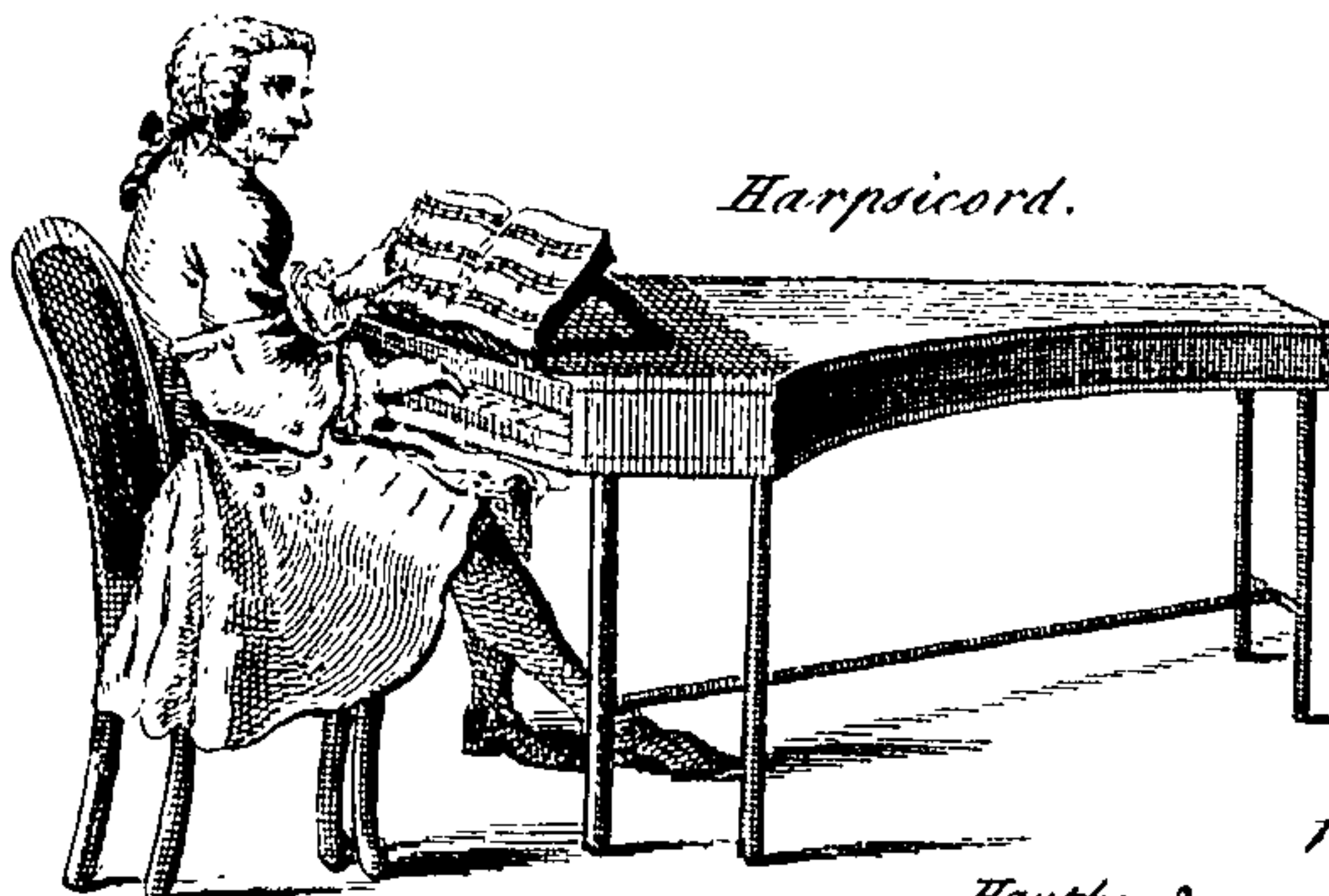
French Horn.



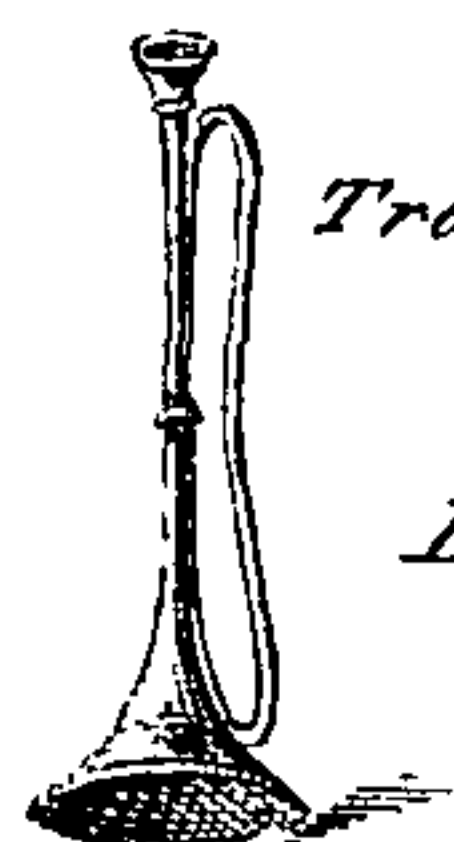
Bassviola.



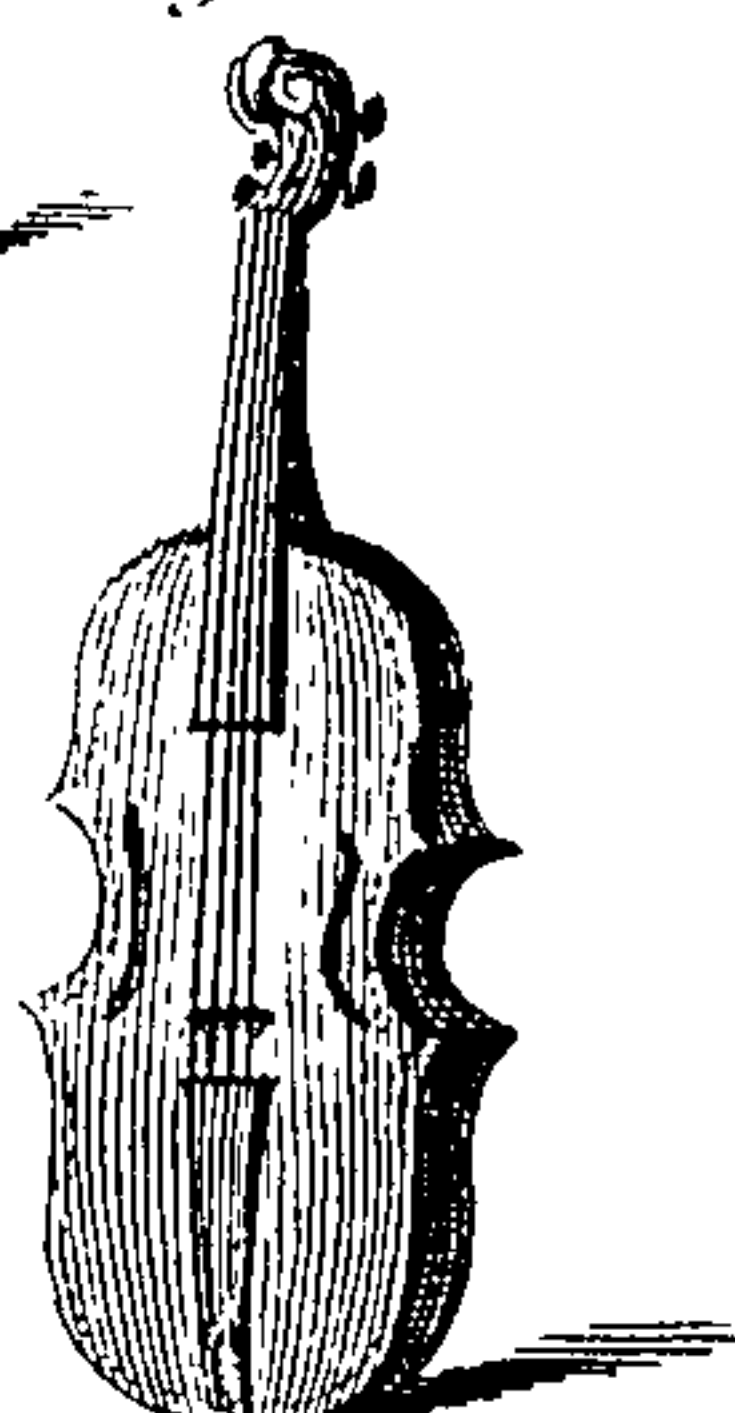
Harpsicord.



Trumpet.



Bassviolin.



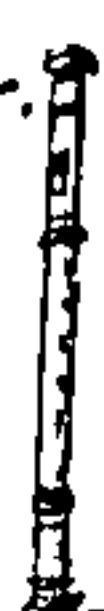
Violin.



Hautboy.



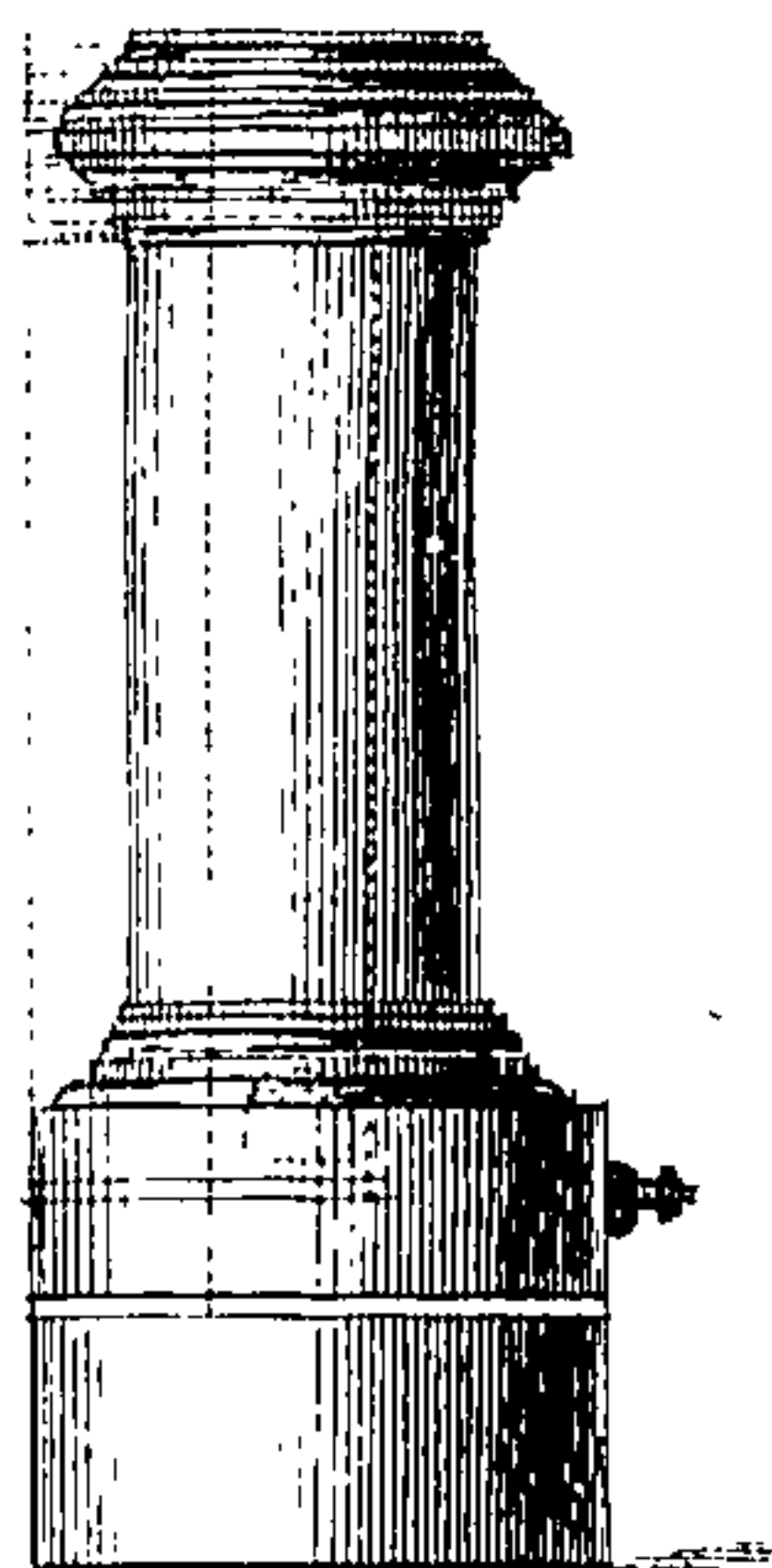
Common flute.



German flute.



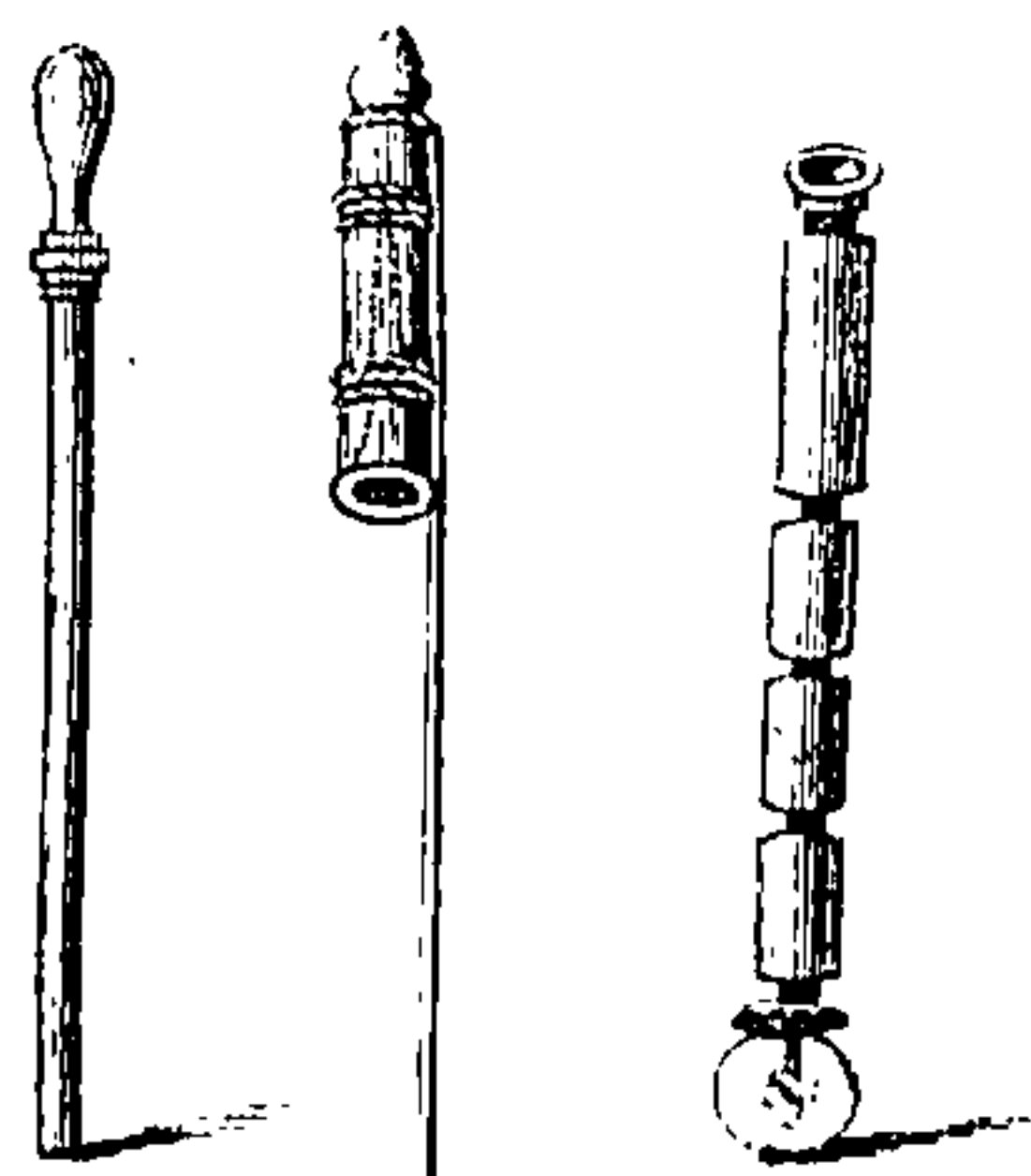
Rockets.



Sculpture.



Rockets.



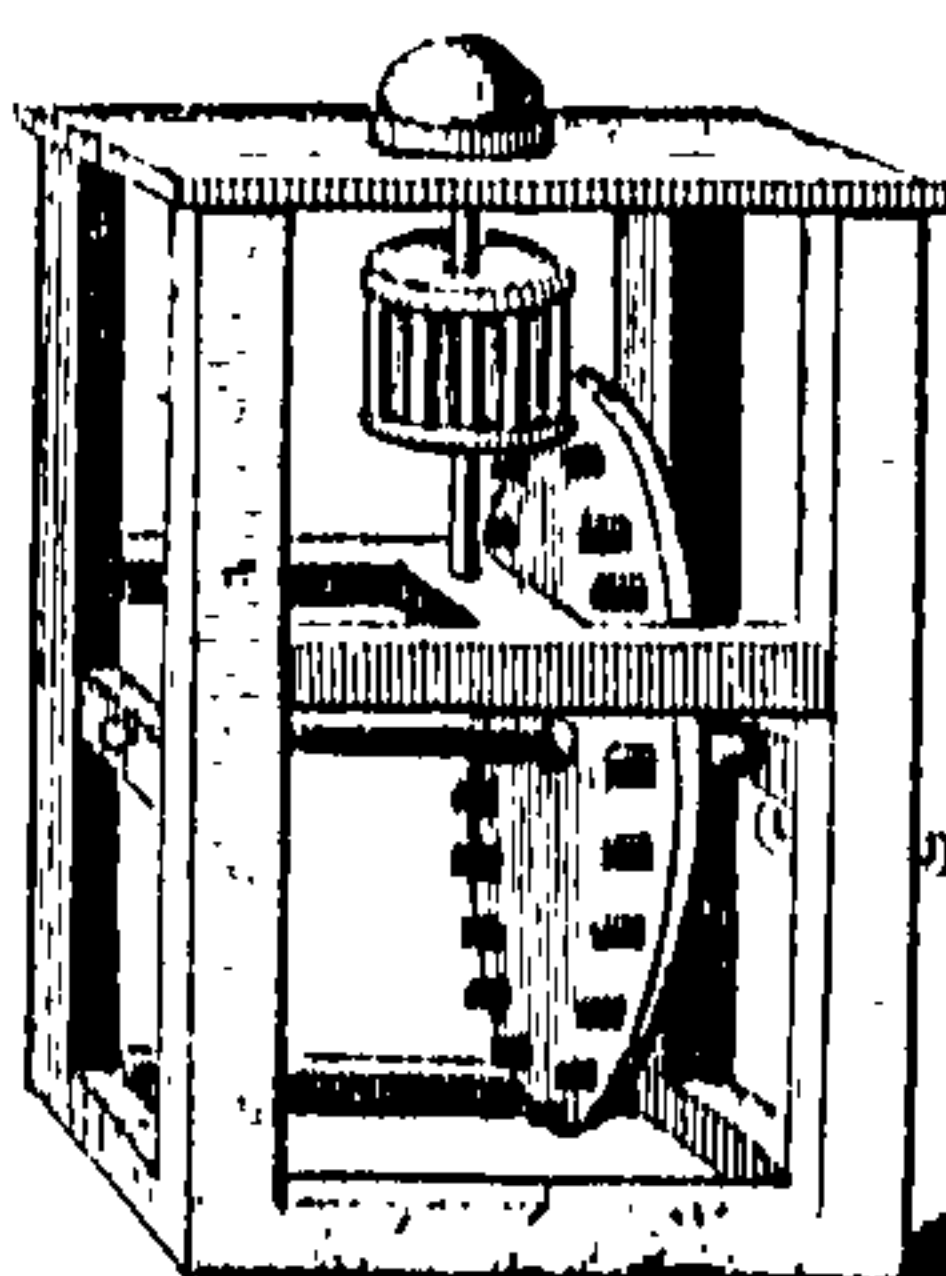
Composing Stick.



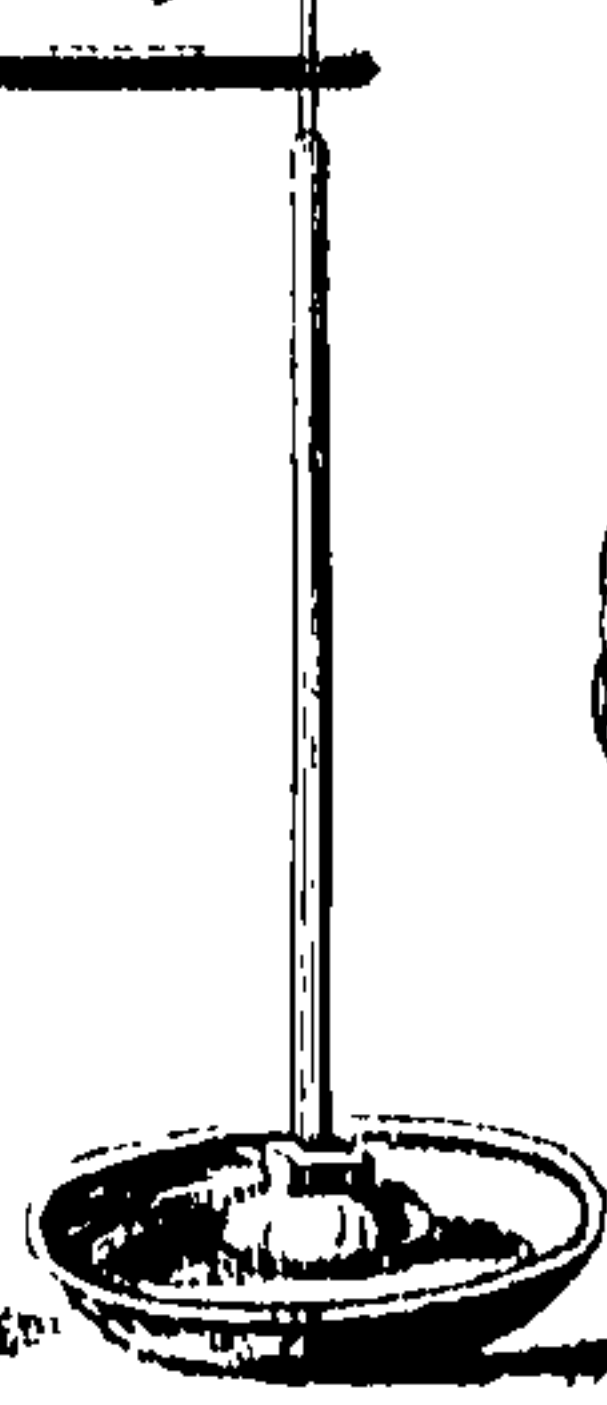
Grinding.



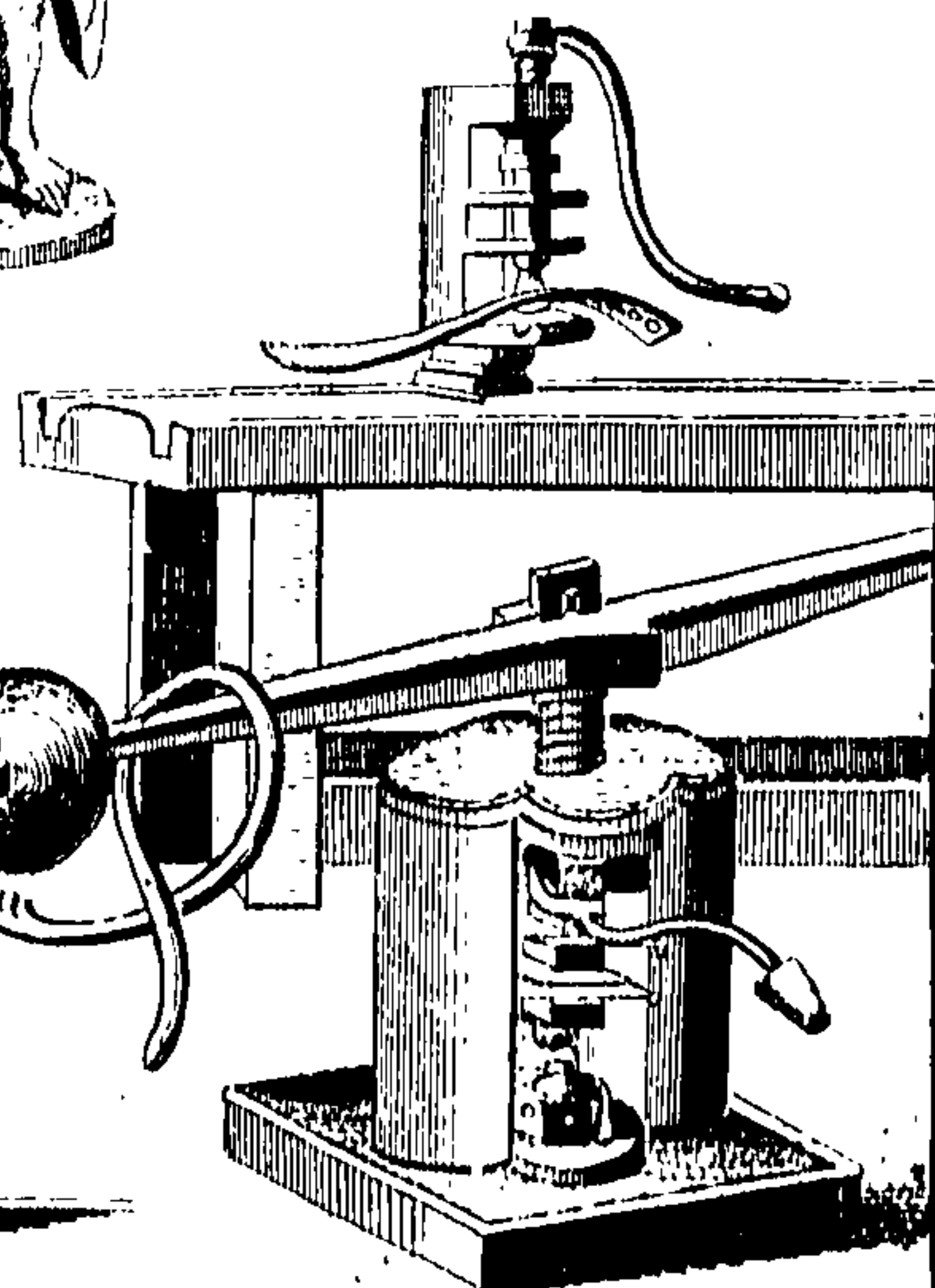
Grinding.



Grinding.



Mill for Coining.



of its Octaves above or below, that Note is called the Key of the Melody, because it governs all the rest, limiting them so far, as that they must be to it in the Relation to the seven essential Notes of an Octave, when any other Note is brought in, it is called *going out of the Key*. From which Way of speaking, *viz.* a Song's continuing in, or going out of the Key, it may be observed, that the whole Octave, with its natural Notes, come under the Idea of a Key; though the fundamental, or principal Note is, in a peculiar Sense, called Key. In which last Sense of the Word Key (*viz.* where it is opposed to one fundamental Note) another Note is said to be out of the Key, when it has not the Relation to that Fundamental of any of the natural Notes belonging to the concinnous Division of the Octave. Here too it must be added, with respect to the two different Divisions of the Octave, that a Note may belong to the same Key, i. e. have a just musical Relation to the same Fundamental in one Kind of Division, and be out of the Key with respect to another. Now a Piece of *Musick* may be carried through several Keys, i. e. it may begin in one Key, and be led out of that into another, by introducing some Note foreign to the first, and so on to another: But a regular Piece must not only return to the first Key, but those other Keys too must have a particular Connection with the first. It may be added, that those other Keys must be some of the natural Notes of the principal Key, tho' not any of them at Pleasure.

As to the Distinction of Keys, we have already observed, that to constitute any given Note, or Sound, a Key, or fundamental Note, it must have the seven essential or natural Notes added to it; out of which, or their Octaves, all the Notes of the Piece must be taken, while it keeps within the Key, i. e. within the Government of that Fundamental. It is evident therefore, there are but two different Species of Keys, which arise according as we join the greater or less Third, these being always accompanied with the sixth and seventh of the same Species; the third G, for Example, with the sixth and seventh G, and the third L, with the sixth and seventh L. This Distinction is expressed under the Name of *sharp Key*, which is that within the third G, &c. and the *flat Key*, which is that within the third L, &c. Whence it is plain, that how many different Cases soever there be in a Piece, there can be but two Keys, if we consider the essential Difference of Keys, every Key being either *flat* or *sharp*, and every *sharp Key* being the same as to Melody, as well as every *flat* one. It must be observed however, that in common Practice the Keys are said to be different, when nothing is considered but the different Tune, or Pitch of the Note, in which the different Closes are made. In which Sense, the same Piece is said to be in different Keys, according as it is begun in different Notes, or Degrees of Tune.

To prevent any Confusion which might arise from using the same Word in different Senses, M. *Malcolm* proposes the Word *Mode* to be substituted instead of the Word *Key*, in the former Sense; that is, where it expresses the melodious Constitution of the Octave, as it consists of seven essential or natural Notes, besides the fundamental; and in regard there are two Species of it, he purposes, that that with a third G, be called the greater Mode; and that with a third L, the lesser Mode, appropriating the Word *Key* to those Notes of the Piece in which the Cadence is made; all of which may be called different Keys, in respect of their different Degrees of Tune. To distinguish then, accurately, between a *Mode* and *Key*, he gives us this Definition, *viz.* an Octave, with all its natural and essential Degrees, is a *Mode*, with respect to the Constitution, or Manner of dividing it; but with respect to its Place in the Scale of Musick, i. e. the Degree, or Pitch of Tune, it is a *Key*; though that Name is peculiarly applied to the Fundamental. Whence it follows, that the same Mode may be with different Keys, i. e. an Octave of Sounds may be raised in the same Order and Kind of Degrees, which makes the same Mode, and yet be begun higher or lower,

i. e. be taken at different Degrees of Tune, with respect to the whole, which makes different Keys; and *vice versa*, that the same Key may be with different Modes, i. e. the Extremes of two Octaves may be in the same Degree of Tune, yet the Division of them be different.

5. *Guido Aretin*, finding that the *Greeks* had good Reasons to divide in two Semi-tones the Intervals between the *Mese* and *Paramese*, which he calls in his System A and B, and the modern *la* and *si*, that obliged him, 1. To put some Time on the Degree of B or *si*, *a b* to shew that from A to B, the Voice should not be raised but of a Semi-tone, and as that Intonation has something more softer and sweet than when the Voice is raised of a full Tone, he gave to that *b* the Epithet of *mol*; which engaged him, 2. To put in his *Gamma* or *Gamut*, a Column, to be seen in our Plate of Miscellanies, called for that Reason the Column of *b-mol*.

Lastly, not satisfied with having added under the *Proslambanomenos*, or lowest Chords of the Antients, a Chord marked with the *r*, and which he called *Hypo-proslambanomenos*, i. e. *subadded*, he added to *Nete-hyper-boleon*, or highest Chord of the System of the antient System, four other Chords, which formed a fifth *Tetrachord*, which he called *Tetrachord* of the *Sur-acutes*. So that his System was composed of 22 Chords, *viz.* of 20 *diatonick*, which make what has been called since the Order *b-quarre*, or natural; and the two lowered a Semitone lower than the natural, which changing the natural Order of some Notes in the Order of *b-quarre*, have produced the Order called *Diatonick b-mol* or simply *b-mol*.

I know that *Meibornius*, and after him *Bontempi*, wanted to rob *Guido Aretin* of the Glory of those Additions, but rather by a Principle of Jealousy and Envy, than with the least Appearance of Reason. But let it be how it will, that System was certainly very ingenious, and has freed the Musick of several Difficulties and Embarrasses, caused by the antient Systems. It is not surprising then, if it was so generally received and applauded; and if it was the only one followed during very near six Centuries successively, notwithstanding which he had three or four very great Inconveniencies.

The first, was that which was called *Muances*, i. e. the different Names one was obliged to give every Moment to the same Note, when the Extent of the Songs obliged to go higher than the *la*, or lower than the *ut*, so that they were obliged very often to call, for Instance, *re*, the same Note, which a Moment before had been called *la*, &c. therefore it is easy to judge what Embarrass that caused; and if an ingenious Author was in the wrong to call those *Muances*, *Crux tenellorum ingeniorum*, the *Cross* of *Pupils*.

The second Inconveniency, was that except the *b-mol*, there was *chromatick* Chords: And it is certainly surprising, that so ingenious and so perfectly instructed in the System of the *Greeks* as *Guido Aretin* was, he had not at least introduced in his System the *chromatick* Chords found in that of the *Greeks*; and which are so frequently used, and so necessary in the Harmony, or Composition in several Parts, that it is almost impossible to make a good Harmony without them.

The third Inconveniency, is the little Extent, or Narrowness of his System; for ever since the Composition in several Parts or different Songs has been in Vogue, it is certain, that neither the two Octaves of the Antients, nor the Additions of *Guido Aretin* have been sufficient.

The fourth Inconveniency was, that the Notes of that System being almost all of an equal Value, that Variety of Measures and Motions could not be marked, which notwithstanding render Musick much more agreeable.

To remedy all those Inconveniencies, it was necessary to form as a fourth System; which notwithstanding, if well considered, is nothing else but an Augmentation or Perfection of that of *Guido Aretin*, and which I call the modern System; therefore,

1. As the Sounds are not naturally found every seventh Degree, precisely in the same Intervals, and can be repeated every Octave, as it were, in infinitum, a seventh Syllable

Syllable has been added, *viz.* *fi*, to the six of *Aretin*, which give the Facility to express all the Degrees of the Octave, to fill all the Intervals thereof, and consequently to make that endless Repetition without changing, but very seldom, the Name of any of the Notes. I say, but very seldom, for some will have it, that when there is a *b*, either after the Key, or in the Sequel of the Song, on the Degree of the *fi*, which marks that from *la* to *fi*, the Voice ought not be raised but of a Semi-Tone; it is proper, to facilitate the Intonation of that Semi-Tone, to say *za*, or *sa*, instead of *fi*; but there are several others, who without changing the Name of the *fi*, content themselves with lowering it of a Semi-Tone; and in Effect, provided that lowering be made just, it is very indifferent what Name be given to that Note.

2. As it was found that between the Chords which are distant, or make the Interval of a Tone, a Partition-Chord could as well be placed to divide them into two Semi-Tones, as between the *Mese* and *Paramese* of the Antients, or which is the same Thing, betwixt the *la*, and the *fi*; they have not been contented with adding to the System of *Guido Aretin* the Chromatick Chord, commonly called *b mol*; but have added to it besides the Chromatick Chords of the Antients, *i. e.* those which divide the Major Tones or Intervals which are in the Middle of each Tetrachord, into two Semi-Tones, which is effected by raising of a Semi-Tone, the lowest of these Chords, which is marked with a double Diezes, thus \times , placed on the left Side, on the same Degree, and immediately before that lowest Note. And as it was observed, that the Tones Minor, or Intervals, which terminate upwards, each Tetrachord is no less susceptible of that Division, than the Tones Major, those Chromatick Chords which were wanted in the Systems of the *Greeks*, have been added to them; so that each Octave is composed at present, of 13 Sounds or Chords, or of 12 Intervals or Semi-Tones, *viz.* of 8 Diatonick or natural Sounds, marked with white Notes; and of 5 Chromatick or Diezes, *i. e.* raised of a Semi-Tone, marked with black Notes, as fig. 6.

With Regard to the enharmonick Chords of the System of the *Greeks*, they have all been absolutely rejected out of the modern System, for the Reasons heretofore mentioned, when I have spoke of the enharmonick Sounds.

3. To remedy the Narrowness of the ancient Systems, and to have different Chords enough to multiply the Parts which make Harmony, the Number of those Chords has been increased by Degrees, as far as 29, Diatonick or natural; and 20, Chromatick. So that instead of four Tetrachords, or two Octaves of the Antients, we have at present 8 Tetrachords, all composed like those of the Example, fig. 6. of 8 Diatonick, and 5 Chromatick Sounds.

Those four Octaves make the ordinary Extent of the modern System, or of the Organs, or harpsical (for there is seldom any found, especially for Organs, which exceed that Extent, either upwards or downwards) and the first Touch or March of the Keys on the left Side, are commonly called, for that Reason, *C, sol, ut*, or simply *ut*.

4. Lastly, as the Notes of the System of *Guido Aretin*, rendered the Tunes so uniform, that it deprived them of that Variety of Motion, sometimes slow, sometimes quick, which make all the Grace or Charm thereof, and obliged often to pronounce in a very disagreeable Manner, the Syllables of the Text, the famous *John de Muris*, a *Frenchman*, and a Doctor of *Paris*, invented about the Year 1340, or 1353, the different Figures of the Notes, which show at once how long precisely each Sound must last.

There are three Things to be consider'd in these Notes of *John des Murs*, — 1. The Quantity, *i. e.* the Size and Figure of the Head. — 2. The Quality, *i. e.* the Colour of the Head, whether it be white or black, full or open. — 3. The Properties, as the *Italians* express themselves, *viz.* whether the Note is accompanied with a Virgula, or Comma, or not. It must, likewise, be considered whether the Notes be separate and distinct, or bound together.

There are most commonly eight Sorts of Notes, *viz.* Names, Figures, and Measures thereof are as fig. 7.

Note, That the ninth Figure was of ancient Use, but has been rejected by the Moderns.

Note also, That the Mathematicians compute, that one may make 720 Changes or Varieties with six Notes, without ever repeating the same twice; and that of the Notes of each Octave, one may make 40320 different Tunes or Songs.

Note again, That the large Note, which is, as it may be seen by the Figure, a long square Note, with a Tail on the right Side, and is worth 8 binary Measures, *i. e.* at two times, is not of any Use in the modern Musick, ever since the Usage has prevailed to separate the Measures, and to bind the Rounds with a Semicircle to mark the Continuity of their Sound. That the long, which by Inspection appears to be a square Note with a Tail on the left Side, and is worth four binary Measures, for at two times, and consequently eight times, unless it be bound with a Breve or Square. That the Breve of a square Figure, called for that Reason, *Square*, by the *French*, is worth under the Signs of the Measure at two or at four Times, two Measures; under the Signs of a triple Major, or perfect Time, is worth three Times, when followed by one or several semblable Squares, thus $\square \square \square$ or by a Point thus $\square \bullet$. But when it is followed by a Note of less Value, as by one \bigcirc or two Whites, it is worth but two Times. That a *Minim*, or White, under the Sign *C*, is worth half a Measure. In the Triple is worth, sometimes one Time, sometimes two: Sometimes also, there want two to make one Time.

As to the Notes bound together, we must observe, 1. That none but the square Notes and the Breves are capable of being bound together, their Figure allowing that they should be approached so near one another, that they appear to make but one Figure, only placed on different Degrees, thus $\square \square \square$ without it be necessary

to put a Semicircle, above or under it, to mark the binding. 2. That it is only a Question here of the binary Measure, or at two Times. 3. That they may be consider'd as simple, as having a Tail. 4. As being of different Colours.

If they be simple, they either go in ascending, and then they are all worth their natural Value, *i. e.* two Measures each. See A. But if they go in descending they'll be worth each, four Measures, if there be but two together as B. But if there be three or four together, then the first and last will be worth each four Measures; and those in the Middle will be worth but two, as A B C, fig. 8.

If they have a Tail (though commonly, none but the first of each Ligature has one, which is ordinarily on the left Side of the Note) either that Tail ascends upwards, and then all the Breves or Squares, as well in descending as in ascending, are worth each but one Measure, as D, which was invented because the Rounds and Minims are not of a Figure to be bound together, and that the Use of the Demi-circle or Ligature, was not yet introduced. But if that Tail hangs downwards, then it gives the Breve its natural Value of two Measures, as well in descending as in ascending, like E, fig. 9.

Lastly, if they be of different Colours, *i. e.* if the first be white, and the second black; then the first is worth one Measure, and the second one white pointed, or a Time and a half; for Example, fig. 10.

These are the principal Ligatures, and those most in Use at present; and we must observe, before we leave this Subject; that they are either of two Notes, or of more than two, or of a single Body, or right or indirect, or with a Virgula or Tail, or without a Tail, or perfect, or imperfect.

Note, That Virgula's or Tails, are those straight Lines added to the Body or Head of the Notes. *Bontempi* distinguishes several Sorts of them in his *Historia Musica*, *viz.* the ascending Tail, which is that which ascends upwards; the descending, that descending downwards.

wards. Both can be placed on the right of a square Note, and are then called *ascending Tail*, or *pendente della parte destra*; or on the left, and is called *pendente della parte sinistra*. Those different Situations, cause much Difference in the Value of the Notes, especially when they are bound together. *Virgula diritta*, is a *straight Tail*, like those of the Whites and Blacks. *Virgula obliqua*, is a Tail with a little Hook at its Extremity, like those of the Crotchets, whether Whites or Blacks. Whether that Hook be turn'd towards the Right or the Left, it matters not. *Virgula biforta*, is a Tail which has a double Hook at its Extremity, like those of the double Crotchets, whether White or Black, &c.

Note also, That thus far I have given the History and Explication of the different Systems of *Musick*, at least of those which are come to our Knowledge; and in our Plate of *Musick* the Curious will see at once all that I have hitherto said of those Systems; and here follows, at the same Time, the Use that can be made of it; and the Advantages which can be drawn from it: For,

1. There are seen in it the Names of the fifteen Diatonick Chords, and of the *Trite-Synemmon* of the System of the *Greeks*, with that remarkable Circumstance, that the Chords whose Names are written quite near one another, make between themselves but a Semi-Tone, and those between whose Names there is a White, make between themselves a whole Tone.

2. In it is seen the Chord *Hypo-Proslambanomenos*, or *Gamma* added underneath; and the Tetrachord of the four *Sur-Acutes*, added a-top the antient System, by *Guido Arctin*.

3. It shews the Use of the Lines, and of their Spaces, and how much the different Degrees they form, serve to make the Distinction between the *grave* and *acute Sounds*.

4. It shews us clearly the modern Figure, the Position or Situation, and the principal Uses of the three Keys of our practical *Musick*; since we see plainly in it, 1. That all the Notes placed on the Line where the Key *G* is situated, are *sol*; that those on the Line *C* are *ut*; and those on the Key *F* are *fa*; whence it is easy to know, in discounting (whether in ascending or descending) which Notes are on the other Lines, and in the Spaces. 2. In it is clearly seen that the Key *G*, marking one Part of the Notes of the third Octave, and all those of the fourth, is designed for the highest or most acute Sounds of the modern System: That, on the contrary, the Key *F*, marking all the Sounds of the first or lowest Octave, and the greatest Part of the Sounds of the second Octave, is designed for the most grave Sounds of the System: And lastly, that the Key *C*, marking one Part of the Sounds of the second and third Octave, is designed for the Sounds between the most grave and the most acute.

5. I have placed above each Note, the modern Name of each Sound, whereby it is easy to discover the Use of the Syllable *fi*, which gives leave to repeat and multiply as it were, *in infinitum*, the Sounds of *Musick*, either in ascending or descending, without changing the Names.

6. In it are all the Notes or Chords, which form the common Extent of the Keys of an Organ, not only the Diatonick or natural, marked with white Notes; but likewise the Chromatick, *i. e.* those with a *b mol*, and with Diesis, marked with black Notes; and all that so distinctly divided into four Octaves, that one must see at once, 1. In what Octave each Sound is situated. And, 2. What Degree precisely each Sound occupies in that Octave.

7. Underneath all that, are found, 1. The Letters or Characters the *Latins* used, ever since *Boetius's* Time, to that of *St. Gregory*. 2. The Letters of *St. Gregory*.

3. The Letters or Keys of *Guido Arctin*. 4. The Letters of the modern System, used by some for the Tablature of an Organ, and commonly used in the *Factice*, especially of Organs and Harpsichords, to mark the Measures of the Pipes or Chords.

8. But what must be particularly observed for the Use and Commodiousness of this Table, is, that by

Means of the punctuated Lines, which run perpendicularly through it, may be seen in an Instant, the Report which all those Systems have with one another, and the Degree which each Chord occupies in the modern System, with the Name given to it. For Example, to know with Regard to our *Musick*, what was the *Proslambanomenos* of the Antients, one must only search in the System of the *Greeks*, which is a-top of the Table the Word *Proslambanomenos*, and afterwards descend along the punctuated Line, answering to it, as far as to the modern Names of the Notes, and he'll find that that Chord answers to the *la* of the first or lowest Octave, of the Organ or modern System. Thus the *Mese* answers to the *la* of the second Octave; the *Paramese* to the *si* of the second Octave; the *Nete-Hyperbolean*, to the *la* of the third Octave, &c.

Likewise, if one will know, for Example, how the *Greeks* called the *re* of our second Octave, he should search in the second Octave of the modern System the Note *re*, and from thence ascending along the punctuated Line, which answers to it, as far as to the System of the *Greeks*, he'll find that our *re*, was their *Iychanos-Hypaton*.

Besides, as several antient Manuscripts are found yet, where the Sounds were marked only with the Letters of the *Latins*, or of *St. Gregory*, or of *Guido Arctin*, if one ascends from the Letters in Question, to the Notes of the modern System, he'll find not only the Name given at present to the Sound marked by that Letter, but likewise, what Octave, and what Degree of that Octave, that Sound occupies in the modern System.

Lastly, if examining the *Diapason* of an Organ or *Harpsichord Builder* (*i. e.* a certain Table where the Length and Bigness of the Pipes or Chords are marked by Lines) you'll find for Instance, a great *C*, at the End of one of those Lines, search that great *C*, among the Characters of the modern System, which make the last Line downwards of our Table; from thence re-ascending along the punctuated Lines, as far as the modern System, you'll find that that Line is the Measure of the Pipe or Chord which must sound the *ut* of the first or lowest Octave. If there be but a small *c*, it will be for the *ut* of the second Octave. If there be two, thus $\overset{c}{c}$, or thus *c c*, it will be for the *ut* of the third Octave. If there be three; it will be for the *ut* of the fourth Octave. If four, it will be for the *ut* of the fifth Octave, or last Touch of the Organ, &c. all which is to be seen in the Table in our Plate of *Musick*.

Note, That besides the Sorts of Systems heretofore explained, there are several others found in Authors, which I'll only mention in this Place. The first is that of the *Italians*, called *Systema Massimo, immutabile, Diatonico, Pythagorico*, and with the *Greeks*, *Bis-diapason*, because it contains two Octaves. This is the System of the *Greeks* heretofore explained. The second is *Systema unguale*, invented by *Aristoxenes*. The third is *Systema reformato*, under which is included *Systema temperato*, or *participato*. Lastly, there is a *Systema Enharmonico, Chromatico, Diatonico, Tonico, Antiquo, Moderno*, &c.

Note also, That *M. Sauveur*, a *Frenchman*, has invented a System of *Musick*, very different from those heretofore mentioned. He divides the Octave into 43 Parts, which he calls *Merides*, and even subdivides it into 301 Parts, which he calls *Eptamerides*. His System has this Advantage, besides several others, that giving different Names to each *Meride*, the diezed Notes have a Name different from the natural, which helps much towards their Intonation: What appears troublesome in it, is to be obliged to retain 43 different Names or rather 301, which one must know when he will make Use of the Octave divided into *Eptamerides*. That System is very ingeniously invented, but it will meet always with many Difficulties, especially in the Execution of a Piece of *Musick* with strong Parts; by it being almost impossible to play the thorough Base thereof on a Harpsichord cut according to that Division, if even that thorough Base was worked with Care and Attention.

Note,

Note, again, That from those different Systems I'll pass to the *Genera*s of *Musick*.

GENUS, in *Musick*, is a Manner of running through different Degrees or Sounds, and the sensible Intervals, which compose the Extent of the Octave, or of its Replies.

The Antients distinguished commonly three Kinds of Genera's, viz. the *Diatonick*, *Chromatick*, and *Enharmonic*.

The *DIATONICK*, is that Genus, the lesser Intervals whereof, are the Semi-tone Majors and the Tones; and is when the Modulation follows the natural Order of the Sounds, i. e. that Distance put in it by Nature, and which the most ignorant observe naturally, if they have a good Ear, and the Organs of the Voice just. According to that natural Order there is a Tone between all the Notes of *Musick*, except between *mi*, *fa*, and *si*, *ut*, which are Semi tones major; when they are changed by means of the *Diezes* or *b-mols*, that Order is either altered or changed, or it is changed every where, so that all those Intervals are divided in two Semi-tones, viz. the major and minor; then it is the pure *chromatick* modern, which is not of great Use: But if that Alteration be made in some Places only, and when it is wanted, then it is a mixed Genus, called *Diatonick-chromatick*, which is the only one proper for good Harmony, and the only one in Use in the modern *Musick*.

The *CHROMATICK*, is when the Modulation proceeds by Semi tones major and minor, and generally as often as the *Diatonick* or natural Order which is between the Sounds is changed in altering them, i. e. raising them by Degrees, or lowering them by *b-mols*; for it is not, as several pretend, when there are several *b-mols*, or several *Diezes* after the Key; since it is then but a Transposition made by means of the *chromatick* Signs; for if the Tune does not proceed otherwise than by Tones and Semi-tones major, it can be to the utmost but a transposed *Diatonick*.

As to the *enharmonic* Genus, which is of no Use at present, I have given elsewhere an Explication thereof.

Note, That the three *Genera*'s could be of no Use, when *Musick* consisted only in the Melody and simple Songs, i. e. in several Songs disposed, and heard one after another; but ever since Songs have been disposed, so that being heard together they do not offend the Ear (which is properly called Harmony) it has been absolutely necessary to leave out the third, the almost insensible Intervals whereof can contribute but very imperfectly to a good Harmony, and form a fourth Genus of the two first, viz. of the *Diatonick* and *Chromatick*; which Genus is called sometimes *Diatonick-chromatick*, when the *Diatonick* is dominant, i. e. when there are but few *Diezes* or *b-mols* in the Parts; and sometimes *Chromatick-diatonick*, when on the contrary the *Diezes* and *b-mols* are frequently employ'd in the Course of the Songs. And as the *b-mols* produce commonly major Semi-tones, and the *Diezes*, minor Semi-tones, the *Chromatick-diatonick* is divided into three Species, the first whereof is the *Chromatico-diatonico per semitoni maggiori*, and is when the *b-mols* are dominant, or more frequent than the *Diezes*; The second is the *chromatico diatonico per semitoni minori*, when the *Diezes* are dominant: The third is *chromatico-diatonico per semitoni maggiori e minori*, when the *Diezes* and *b-mols* are very near equally employ'd.

Note, also, That the next Thing which falls under our Consideration, are the *Modes* or *Tones*.

MODE, in *Musick*, is a particular Manner of beginning, continuing, and ending a Song, whereby we are engaged to make use of certain Notes, or Chords, preferable to, or oftner than others.

Mode, is defined by some Authors the particular Manner of constituting the Octave, or the melodious Constitution of the Octave, as it consists of seven essential, or natural Notes besides the Key, or fundamental.

To understand well what a *Mode* is, according to our first Definition, we must observe, 1. That in every Tune or Song there is three principal Chords; the first, is that whereby a Song is almost always begun, and where it

must be always ended, wherefore it is called the *final*. The second, is that which is repeated, and which is heard oftner than any other, wherefore it is called the *dominante*. And the third, as being between the other two, is called the *mediante*, and is commonly a Third above the *final*. These three Chords are otherwise called the *essential Sounds* of the *Mode*.

2. The Antients formed their *Modes* of the *diatonick* or natural Chords; therefore as there are but seven *diatonick* Chords in the Extent of the Octave, it can be said that there are but seven Chords whereby a Song can be terminated, and consequently but seven Sorts of *Finals*, at least *diatonick* ones, viz. C, D, E, F, G, A, B, or, according to the modern Manner, *ut*, *re*, *mi*, *fa*, *sol*, *la*, *si*.

3. Each of those Chords has another eight Degrees higher, whose Sound is more acute, and which serves for an Octave to it, making up therefore seven Kinds of *Octaves*, in the two Extremes thereof, are limited the *Circumference*, *Extent* and *Capacity* of each *Mode*; therefore in their Opinion, to *modulate*, and *Modulation*, was nothing else but to make a Song pass through all the Sounds comprized between those two Extremes, notwithstanding, as to pass oftner through the essential Sounds than through the others, and that always *diatonically*.

4. Among all the Songs comprized in the Extent of the *Octave*, there is always one which divides it *harmonically*, i. e. which is just a Fifth above its lowest Chord; and another which divides it *arithmetically*, i. e. which is a Fourth higher than its lower Chord; for Instance, fig. 11.

This double Division has formed the two Classes of *Modes*, so often mentioned in Authors, viz. that of the authentic *Modes*, and that of the *Modes plagal*. For when in a Song the Sound, which is one Fifth above the lowest Chord of the Octave of a *Mode*, is repeated and often heard, then a *Mode* is *authentic*; and when that which is but of one Fourth distant from it, or another which makes a Third against its final is repeated, it is a *plagal Mode*; for Instance, fig. 12.

5. But as among the seven Species of *Octaves* above-mentioned, there are but six which can be divided *harmonically*, or by the just Fifth, viz. the *Octaves*, C, D, E, F, G, A, because the Fifth of the *Octave* B or from *si* to *fa* in ascending, is *diatonically* false or diminished: There are also but six *authentic Modes*; as on the other Side there are but six *Octaves* which can be divided *arithmetically*, or by the just Fourth, viz. the *Octaves*, C, D, E, G, A, B, because the fourth of the *Octave* F, or from *fa* to *si*, in ascending, is superfluous. There are likewise but six *plagal Modes*; therefore the *Octaves*, C, D, E, G, A, have each two *Modes*, one *authentic* and the other *plagal*; the *Octave* F has but one which is *authentic*; and the *Octave* B has but one likewise, which is *plagal*; which makes up twelve in Number, to which *Glarean* and *Zarlino*, and several others after them, have fixed the Number of *Modes*. In fig. 13. is a Table which contains all that in a very clear Manner.

The antient *Modes*, besides their general Division into *authentic* and *plagal*, had also their respective Names from the several *Greek* Provinces, where they are supposed to have been invented. Originally indeed there were but three, viz. *Doric*, *Lydian*, and *Phrygian*; which were particularly called *Tones*, because at a Tone's Distance from one another. The rest were added afterwards, and were some of them named from the Relations they bore to the former, particularly the *Hippo-doric*, as being below the *Doric*.

The *Doric Mode*, was a Mixture of Gravity and Mirth, invented by *Thamyris* of *Thrace*.

The *Phrygian Mode*, was adapted to the kindling of Rage, invented by *Marupas* the *Phrygian*.

The *Lydian Mode*, was proper for Funeral Songs, invented, according to *Pliny*, by *Amphion*.

The *MYXOLODIAN*, was invented by *Sappho*. The *Aeolic*, *Ionick*, and *Hypo-doric*, by *Pholixenus*, and the *Hypo-Lydian* by *Polymnestes*. Besides those Names are found those of *continuo*, *commune*, *misto*, &c.

The *CONTINUO*, is mentioned by *Julius Pallas*, and was, according to *Zarlino*, much like the *perpetuum*, though

though harmonious the Buzzing of a Musette, or Bagpipe.

The COMMUNE, according to the Philosopher *Gaudencius*, is the same with the *Hypo-dorick*, the lowest Chord whereof is A, *mi, la*; its Final, which divides arithmetically its Octave, i. e. one Fourth above the lowest Chord, is D, *la, re*. The Chords it repeats oftner are D, *la, re*, whereby it most commonly ends; and F, *ut, fa*, which serves for *dominante* to it. In the *plein Chant*, it is the second Tone; it is transposed in Musick, one Fourth higher in G, *re, sol*.

The MISTO, or MIXTO, *mixt*, is the Name which the Antients gave to some of their *Modes*, when they participated of the *authentick*, and of the *plagal*.

Note, That the *Hypo-eolick* abovementioned, is the *plagal* of the *Eolick-Mode*. Its lowest Chord is E, *si, mi*; its final, which divides arithmetically its Octave, is A, *mi, la*; the Chords which it repeats are C, *sol, ut*, and E, *si, mi*; which serves to it of *dominante*. It ends commonly by A, *mi, la*, and is therefore very near our third Tone. That the *Hypo-ionick* is the *Plagal* of the *Ionick Mode*, its lowest Chord is G, *re, sol*, its final is C, *sol, ut*, one Fourth above; the Chords it repeats are C, *sol, ut*, and E, *si, mi*, which serves it for *dominante*: It ends by C, *sol, ut*, it is very near our fifth Tone. That the *Hypo-lydian* is the *Plagal* of the *Lydian Mode*; its lowest Chord is C, *sol, ut*, its final one Fourth higher is F, *ut, fa*. the Chords it repeats are F, *ut, fa*, and A, *mi, la*, which serve for *dominante* to it; it ends commonly by F, *ut, fa*, and is very near our sixth Tone, meaning in the *plein Chant*. That the *Hypo-mixolydian* is the *plagal* of the *Mixolydian Mode*; its lowest Chord is D, *la, re*, its final one Fourth higher is G, *re, sol*; The Chords it repeats are G, *re, sol*, and B, *fa, si*, and oftner C, *sol, ut*, which serves of *dominante* to it. It ends in G, *re, sol*, it is our eighth Tone, meaning in the *plein Chant*.

6. This Manner of settling and explaining the Modes was supportable, when only *diatonick* Chords were used, ever since the Use has been introduced of dividing the Octave in 12 *chromatick Semi-tones*, that Distinction of *plagal* and *authentick Modes* has soon been rejected. It has been seen that a *plagal Mode* was not properly a *Mode*; that it was to the utmost but an Extension of the *authentick Mode*, and that all Modes should be *authentick*. In a Word, an Infinity of very fine new discoveries have been made, unknown to the Antients; therefore here is a new System of *Modes*, received at present by all Persons of a good Taste.

7. All Modes must have three Chords, called *essential*, viz. the *Final*, *Dominante*, and *Mediante*: The *Final* may be any Chord whatever, whether *diatonick* or *chromatick*, of the Twelve comprized, which is one Fifth just above the *final*; and if it be not so naturally, it must be rendered just *accidentally* by means of the *Diezes* or *b-mols*, placed commonly immediately after the Key or the Degree of that *dominante*. Lastly, the *mediante* is that which dividing the Interval which is between the *dominante* and the *final* in two Thirds, makes likewise what is called the *harmonic Trio*. These are what should be properly called the *essential* Chords of a *Mode*.

8. It must be observed, that the third made above the *final*, can either be *major* or *minor*; if it be *major*, i. e. composed of two full Tones, as *ut, mi*, then the *Mode* is, and is called *major*, or *beccare*; if that third be *minor*, i. e. is composed but of one Tone and a Semi-tone, as *re, fa*, then the *Mode* is, and is called *minor*, or *b-mol*. Therefore as there are but two Sorts of Thirds, there are in general but two Classes of *Modes*, viz. that of the *majors*, and that of the *minors*; and as of the twelve Sounds, whether *chromatick* or *diatonick*, which are within the Extent of the Octave, there is none on which one could not make, either *naturally* or *accidentally*, a third *major*, there are then twelve *Modes major*; and as a third *Minor* can be made on every one of them, there are likewise twelve *Modes minor*.

9. It must be observed again, that besides the three *essential* Chords abovementioned, there are in each *Mode* two other natural ones, because a fine Song cannot be made, nor even a *gracious Harmony*, without their As-

sistance. Those two Chords are, 1. In each *Modé* whatever, a *Semi tone major*, whether *natural*, or *accidental* under the *final*. 2. For the *Modes minor*, a *Semi-tone major*, above their *dominante*. 3. For their *Modes major* a full Tone above their *dominante*.

Lastly, there are besides two other Chords, which, though not *essential* like the three first, nor so *natural* as the two last, can very well be called *necessary*, which are the full Tone above the *final*, and another full Tone under the *dominante*.

10. If all those Chords are found placed *naturally*, as I have just now said, then the *Mode* is *natural*, but if one is obliged to have Recourse to the *Diezes*, or *b-mols*, either immediately after the Key, or in the Course of the Song, to establish that Order between the Chords of a *Mode*, it is then a transposed *Mode*. On that Principle there is but the *Mode C, sol ut*, which is truly *diatonick*, or *natural*, all the others wanting some *Diezes* or *b-mols*, either to put the final in the Degree wanted, and then they are *chromatically transposed*, or to render the fifth just; whether to make their *third major* or *minor*, or to make that there should be but a Semi-tone above the *dominante*, or under the final; or lastly, to make that there should be a full Tone under the *dominante*, and above the final.

11. One can, and it is even proper, to make a Song go out of the *Mode*, by making it enter into another, and from that into a third, &c. but one must return, and end by the final Cadence of the *Mode*, whereby one has began: While one stays in that *Mode*, no Cadence is to be made but on the *essential* Chords of that *Mode*; if any be made on other Chords, from that Time he declares that he will go out of it; and even no perfect Cadence can be made on the *mediante* of the *major Modes*, without going out of it; and some pretend that it is the same Thing for the *mediante* of the *minor Modes*.

12. It is also a Principle equally sure as the preceding one, that one is not thought to remain in his *Mode*, unless he causes to be heard, either in the Base, or in some of the superior Parts, or, what is still better, in several Parts at once, several, or one at least, of the *essential*, or *natural Chords* of the *Mode*; to act otherwise, is to go out, or declare that one will go out of the *Mode*. It is for that Reason that the sixth, and even often the *superfluous Fifth*, are better on the *mediante* of a *Mode*, than the fifth just, unless a Cadence be made upon it: For the same Reason the *sixth major* is best on the Note which follows immediately, in ascending, the final of the *Modes minor*, than the *sixth minor*; and the *third minor* is better on the Note which is immediately under the *dominante* of the *Modes minor*, than the *third major*. Lastly, it is for that Reason that the *dominante* of what *Mode* soever requires *naturally*, rather the *third major*, than the *minor*; and that the final of the *Modes minor* requires on the contrary rather the *third minor* than the *major*, unless it be at the End of a Piece, where Use will have it; and the Ear requires that the *third major* be rendered *accidentally*, if it was not so naturally.

Note, That this which the Moderns have been pleased to call *Modes*, the Antients called *Tune*, and is more properly adapted to Church Musick, in French called *plein chant*, than to any other; and though this Sort of *Tune* be very little in Use here in England, except it be in the Cathedral Churches, where they have retained something like it, as my Work has the Character of Universality, I must say something further on the same Subject, which is very essential, reserving to speak afterwards of *Tune* with regard more particularly to Musick; therefore,

We'll observe, 1. That eight *Tones* are commonly and regularly reckoned, in what we call at present, in general, *Gregorian Tune*, or *plein chant*, four of which are *authentick*, and four *plagal*.

The four *Tones authentick* are properly the *Dorick*, *Phrygian*, *Lydian*, and *Mixolydian*, of the ancient *Greeks*, chosen by St. Ambrose in the Year 370, to compose of them the Musick of the Church of Milan.

To form those four *Tones*, they employ'd but eleven Chords of the ancient System, the *Iychmas lyraion*, i. e. the *re* of our second Octave, being the lowest Chord of the first Tone; and the *Paremete-biarbelen* being the highest

highest of the fourth; therefore the *Note*, which is the highest, and the *Perypate-Hypaton*, the *Hypate-Hypaton*, and the *Proslambanomenos*, which are the three lowest Chords of the System, were not employ'd in it.

It is, without doubt, what gave the Idea to St. Gregory, about 230 Years after St. Ambrose, to add to those four *authentick Tones*, the four *Plagal*, viz. the *Hypo-Dorick*, *Hypo-Phrygian*, and *Hypo-Mixolydian* of the Antients, in order to introduce into the Church-Musick, the 13 Chords of the antient System; the *Hypo-dorick*, having for its lowest Chord the *Proslambanomenos*, or added, which is, also, the lowest of the whole System.

2. Whence the four *authentick Tones*, have each one of the *Plagals* for Collateral, *i. e.* to serve as of Supplement to it, &c. which is the Reason why they are separated into four Classes, placing the first and second Tone in the first Class; the third and fourth in the second Class; the fifth and sixth in the third, and the seventh and eighth in the fourth; as in the following Table.

| | | | | | |
|-------|----|----|----|----|--------------------|
| Tones | 1. | 3. | 5. | 7. | <i>Authentick.</i> |
| Tones | 2. | 4. | 6. | 8. | <i>Plagal.</i> |

3. There are two Things to be observed in this Table; the first, that the four *authentick Tones* are expressed in it, by the uneven Numbers, 1. 3. 5. 7. whence they have borrowed the general Name of *uneven Modes*, or *Tones*; and the four *Plagal* by the even Numbers 2. 4. 6. 8. whence their Name of *even Modes*, or *Tones*. These two Denominations are very frequent in Authors who have treated on this Subject, therefore it is necessary to know the Signification thereof.

The second Observation is, that the *authentick Tones* are here placed above the *Plagal*, because they are in fact the *superior*, the Principal, the Keys, the Dominant, &c. and the *Plagals*, on the contrary, are in the lower Rank, because they are collateral, subordinate, dependant, &c. of the *Authenticks*.

2. To determine justly what Tone is used to compose a Song, Regard must be had to three Things. 1. To the *final*, or last Note of that Song. 2. To the *Extent* which has been given to it, as well upwards as downwards. 3. To the *Dominant*, *i. e.* commonly to the Note which is oftener repeated in the Piece. For by the *final*, we shall infallibly know of what Class the Tune of that Song is, since each of those four Classes has a Note so particularly affected to it, that it serves always of *final* to the two Modes or Tunes it includes; thus,

The two Tones of the first Class, viz. 1. and 2. have always for *final* a RE.

The two Tones of the second Class, viz. 3. 4. have always for *final* a MI.

The two Tones of the third Class, viz. 5. 6. have always for *final* a FA.

Lastly, those of the fourth, viz. 7. 8. have always for *final* a SOL.

Therefore when a Piece ends for Instance by a *Re*, it may be concluded, that it is composed on one of the Tones of the first Class; and consequently of the first or of the second; when it ends by a *Mi*, it is of the second Class, and consequently of the third or fourth Tone; and thus of the others.

It may be objected to this, that there are several Songs, which end with a *la*, others with a *fi*, others with an *ut*, &c. to which I answer, that as the Notes *la*, *fi*, *ut*, are precisely in the same Proportion with the Sounds expressed by the Notes *re*, *mi*, *fa*; it may be said that the *la* supplies the Place of the *re*; the *fi* that of *mi*; and the *ut* that of *fa*. Therefore it is always the same Song, but transposed a 5th higher or a 4th lower; without that Transposition changing any Thing in the Essence of that Song; nor the natural Order of the Tunes; and consequently cannot make it change Class, it being very easy to reduce the three Notes *la*, *fi*, *ut*, to the Notes *re*, *mi*, *fa*, whose Place they supply. Therefore it must be said, for Instance, that the two Tones of the first Class have naturally and commonly a *re* for final, and sometimes *la* for Transposition; and thus of the others, as it appears by Inspection in the following Table:

| First Class. | Second Class. | Third Class. | Fourth Class. |
|-------------------------------------|-------------------------------------|-------------------------------------|---------------|
| 1. RE or LA 2. By Transposition. | 3. MI or SI 4. By Transposition. | 5. FA or UT 6. By Transposition. | 7. SOL. 8. |

But this is not sufficient, for as each Class includes two Tones, one of which is *Authentick* or *uneven*, and the other *Plagal* or *even*; it remains still to determine, on which of those two Tones the Piece is composed; but to know it, one must examine which is the Extent, either upwards or downwards of the Tune of that Piece.

For if the Tune of the whole Piece extends as far as to 8 or 9 Degrees upwards, and goes no farther than one Degree lower than the final, then the Tone will be *authentick* or *uneven*; and consequently the first of each Class.

Note, That when the Songs of the *authentick Tones* rise higher than 9 Degrees above their final, they are called *exceeding Modes*, or *superfluous Tones*; notwithstanding which they are still *authentick*. That if, on the contrary, a Song descends 4 or 5 Degrees under the final, and does not rise to the utmost higher than 5 or 6 Degrees above it, then the Tone will be *Plagal* or *even*, and consequently the second of each Class. But if a Song has so great an Extent, as to go as far as to 8 or 9 Degrees above its final, and to descend 4 or 5 Degrees under it; then it is a *mixt Tone*, or *Mode*; because it includes the Extent both of the *Authentick* and of the *Plagal*.

To know at once, and without Difficulty, which are the final, and the *Dominant* of each Tone, here are two Verses which contain both, according to the Method of the *fi*.

Pri. *re*, *la*. Sec. *re*, *fa*. Ter. *mi*, *ut*. Quart. Quoque *mi*, *la*.

Quint. *fa*, *ut*. Sex. *fa*, *la*. Sept. *sol*, *re*. Oct. Quoque *sol*, *ut*.

Note, For the Intelligence of these two Verses. 1. That the Monosyllables *Pri*, *Sec*, *Ter*, *Quart*, &c. are Abbreviations of *Primus*, *Secundus*, *Tertius*, &c. 2. That after each of those Monosyllables are found the Names of the Notes, the first whereof is the *final*, and the second the *Dominant* of each Tone.

TUNE, or *Tone*, in *Musick*, is also taken for one of its Intervals, and even for the first, the Foundation, the Source, Rule, and Measure of all other Intervals. In that Sense the Antients, and the Mathematicians distinguish two Sorts of Tunes, viz.

The *Tone Minor*, whose Proportion is *Sesqui-nimb*, as from 10 to 9, and which is always the third Interval of each Tetrachord. And,

The *Tone Major*, whose Proportion is *Sesqui-eightb*, as from 9 to 8, and which is always the Interval of the Middle of each Tetrachord; as in the following Example:

| | | | |
|------------|-------------|-------------|---------------|
| MI | for 9 to 8. | SOL | from 9 to 10. |
| Semi-Tone. | Tone-Major. | Tone-Minor. | LA. |

It is also in that Sense, that the Moderns (supposing that all the Tones in the temperate System be very near equal) say, that the *Tone* is the Interval between all the Degrees or diatonick and natural Notes of the Octave, except between *mi*, *fa*, and *fi*, *ut*, which are naturally but Semi-Tones.

Lastly, in that Sense it is said, that the *Tone* is a second Major, because it is the Distance from one Sound to another, which are distant from one another of 9 Comma's, &c.

A *Tone* from which 4 Comma's have been re-trenched, is called a *SEMI-TONE*; which is consequently an Interval of 5 Comma's, called otherwise *Semi-Tone Major*, or second Minor. The same Word is used to mark the other half of *Tone*, which has but 4 Comma's of Extent; but it is called for that Reason *Semi-Tone Minor*, or Second diminished.

To understand well what is that *Second diminished*, we must observe, that a *Second* is one of the Intervals of

of *Musick*, which is properly but the Distance from one Sound to the nearest other Sound, either in ascending or descending. But as nine Sounds, sensibly different, which form those small Intervals called *Comma's*, cannot be distinguished in the Extent of a Tone, it could be reasonably said, that there are eight Sorts of Seconds; but as those small Intervals, though sensible, are not sufficient to contribute to the Harmony, that's the Reason, that we distinguish but four Sorts of them.

The first, called *Second diminished*, contains four *Comma's*, and is the Difference for Instance, from a natural *ut*, to the same *ut* risen of four *Comma's*, by the Chromatick Diezes; which is otherwise called, as already observed, a *Semi-Tone Minor*.

The second, called *Second Minor*, contains five *Comma's*; and can be made, either *naturally*, as from *mi* to *fa*, or from *si* to *ut*; or *accidentally*, by Means of a *Diezis*, as from *la* to *si b mol*; or by Means of the *fa* *Diezis* to *sol*; which is called otherwise *Semi-Tone Major*, or *Second imperfect*.

The third is the *Second Major*, which contains the 9 *Comma's* which compose the Tone, whether that happens *naturally*, as between *ut* and *re*, *re* and *mi*, &c. or *accidentally*, as between *mi* and *fa* *Diezis*, &c. this is otherwise called *Second imperfect*.

Lastly, the fourth is the *superfluous Second*, composed of a Tone, and of a *Semi-Tone Minor*, as from the *fa* to the *sol* *Diezis*, &c.

In the System of the Antients, the Second had but one *Replick*, which is the 9th. In the Modern, it has besides that *Replick*, the 16th for *Triplick*, and the 23d for *Quadruplick*, &c. which are all marked indifferently in the *Thorough-Bass*, when the Bass sincopes by a 2, and when the Treble sincopes by a 9. When there is a *b mol* before or after the Figure, it is the Second Minor; and when a *Diezis*, it is the Second superfluous.

These four Sorts of Seconds, are all naturally *Dissonant*; which notwithstanding in the Melody, *i. e.* in the Course of a Song one must very well use the three first, but never, or at least very seldom the fourth. When a Song proceeds thus by Seconds, that is called *conjoined Degree*.

With Regard to Harmony, one must never use the *diminished*, and seldom the *superfluous*; there is properly but the Major and Minor, which can enter in it: But neither one nor the other must be in a *good Time* of the Measure, or if they are, that must be done by *Sincope*; and when the Treble sincopes, then they want to be followed naturally by the Unison in the following Time, or of the Octave, if they be doubled; and of the third if the Bass sincopes. The Seconds, especially in the Expressions of Anguish or Sorrow, have a marvellous Effect; and much more the Minors than the Majors.

As to *Mutations*, when the *Gamut*, called *Mutantes*, was in Use, the Change to be made continually, in the Names of the Notes or Sounds, was called *Mutation*, or *Muance*; so that, for Instance, the same Note which had been called *la*, was to be called *re* a Moment afterwards; which used to be very troublesome, and to which the Gamut by *fi* has remedied.

But the Word *Mutation* signifies, likewise, one of the Accidents which happens in the Order of the Sounds which compose a Song, or a Melody, which Accident happens by a Change; which Change is made in four Manners.

The first in changing the Genus, *i. e.* passing from the *Diatonick* to the *Chromatick*, or *Enharmonick*, and reciprocally from the *Chromatick* to the *Diatonick*, &c. which is called *Mutation by Genus*.

The second in making the Tune of a very acute Sound, to descend to a grave one, the better to express some Words of the Text. That's called *Mutation by System*.

The third is, when to express some Passion, &c. one passes from a Mode into another, as from the Mode Major to the Mode Minor, &c. which is called *Mutation per tuono o modo*.

The fourth is, when one passes from a Manner of singing male and vigorous, called *maniera dissonante*, to a sweeter, more languishing, softer, and more effeminate, called *maniera restringente*; or to a tranquil Manner which keeps a Medium between the two, and

is called *maniera quiza*. All these Manners, and the other Changes, are pathetick, *i. e.* very proper to express the different Passions or Motions of the Soul and Heart.

Note, That having thus far consider'd and explained the first Branch of the *contemplative Part of Musick*, viz. the Grounds, with the various Measures and Degrees of the Agreement of Sounds, in Respect of their Tune; or the Relations and Measures of Tune; I'll pass to the second Branch, which treats of the Numbers of Sounds or Notes with Respect to Time; containing an Explication of the Measures of long and short, or swift and slow, in the Succession of Sounds.

The Word *TIME* has several Significations in *Musick*, 1. It signifies in general one of those three Signs of the Measure, which the *Italians* call *Gradi*, viz. *Time*, *Relation*, and *Sincope*.

TIME, according to the Antients, was a certain Sign placed after the Key, to mark how many Semi-breves or Rounds were contain'd in one Breve or Square. They distinguished two Sorts of Times, viz. perfect and imperfect. A Circle whole or cut, perpendicularly, but without a Point, was the Mark of a perfect Time, under which a Breve, even without a Point, was worth three Semi-breves, as A fig. 8. A Semi-Circle, either whole or cut, was the Sign of an imperfect Time, under which a Breve was worth but two Semi-breves or Rounds; as B, fig. 38.

Others more modern, though they agreed with the Antients on the Division of Time into perfect and imperfect, pretended; 1. That the Signs of the perfect Time, or the Example A, had not the Virtue of rendering the Breve more perfect, unless they were followed by the Figures 3 or 3 and 2, that by Means of those Figures the Signs of the Example B, had the Power to render the Breve more perfect, or to give it the Value of three Semi-breves, as well as those of the Example A.

But if the Signs of the Example B, were not followed by Figures, they made them serve not only for the Measure of the Breve, with Regard to the Semi-breve, but, likewise, for all Notes of less Value without Distinction; and admitted two Kinds thereof, viz. the simple C, which the *Italians* call simply *tempo*, and the C cut perpendicularly, which they call *tempo tagliato*.

The simple C is seen in two Manners, 1. Turned from the left to the right thus C, and then the *Italians* call it *tempo ordinario*, because it is oftener used than any other; or *tempo allo Semi-breve*, because under that Sign a Semi-breve or round \bigcirc is worth a Measure, or four Times, and the other Figures in Proportion. 2. But it is sometimes found turned from the right to the left, thus \complement , then all the Figures are diminished of half their Value; thus one round \bigcirc is worth but two Times; one Minim or White but one Time, and thus of the rest.

The C cut, is found likewise either turned from the left to the right, thus \complement , or from the right to the left, thus \complement . When on the left, the *Italians* call it, *tempo alla breve*, because antiently, all the Figures under that Sign were diminished of half their Value: But at present it marks that the Measure must be beat at two Times grave, or at four Times very quick, unless there be *largo*, *adagio*, *lento*, or some other Term, which advises to beat the Measure slowly. And when with that Sign the Words *da capella*, and *alla breve*, are seen, it marks two very quick Times; which it marks, likewise, when turned upside down; but it is seldom found in that Situation.

Lastly, others still more modern, divide Times into two single Species; the first is *tempo maggiore*, or *Time Major*, which is marked by a \complement cut, and signifies, that all the Notes can be sung *alla breve*, *i. e.* in making them worth but half their Value. The second is *tempo minore*, or *Time Minor*, which is marked by a single C, under which all the Notes are worth their natural Value. And if one and the other of those two Times are followed by three, or any of the other Signs, I'll mention when I speak of the *triple*, then they are called *ternary major*, or *minor Time*.

2. The

2. The Word *Time* signifies not only one of the Signs of the Measure, but likewise the aliquot Parts it is composed of: Therefore we say, that there are Measures at *two*, at *three*, at *four Times*, &c. because the Hand by its different Motions marks as many Parts in each Measure.

But it must be observed, that among the different Times which compose the Measure, there are some more proper than the others, to place a *Consonance* or a good *Accord*; which for that Reason, are called *tempo*, or *tempi di buono*, i. e. a certain *Time* of the Measure which is good, and more proper to certain Things than another; for Instance, to terminate a *Cesura*, or Section, or a *Cadence*; to place a *long Syllable*, a *syncop'd Dissonance*, a *Consonance*, &c. The good Time of any Measure is always the first, which is made in beating; and in the Measure at four Times, the third is likewise a good Time, the others are *Times di cattiva*, i. e. a *Time* where one can place a *Dissonance*, or a *bad Accord*, &c. the *bad Time*, of what Measure soever, is always the second or the last. The *Times* affected to the long Syllables of the Text, are called *tempo*, or *tempi dilonga*; and those proper for the *breve Syllables*, are called *tempo* or *tempi di breve*.

3. We find sometimes after the *Recitative* of the *Italians*, these Words *a tempo*, or *a tempo giusto*, which mark that the Measure must be beat just, and the Times thereof rendered very equal; whereas in the *Recitative* a greater Regard is to be had to the Expression, than to the Justness or Equality of the *Times* of the Measure.

Note, That the *Italians* use likewise sometimes, the Term, *temporegiato*, which signifies the same Thing as *tempo*: Though it often signifies likewise, that those who accompany, and he who gives the Measure, must lengthen sometimes certain Times, either to give the *Actor* the Facility of expressing the Passion, or to give to him who sings, the Time of making the Agreements, wherewith he judges proper to adorn what he sings.

As *Time*, among the Antients was properly the Measure of the *breve* and *semibreve*, *Prolation*, or the Point thus called (which was marked either in a Circle or Semicircle, thus, \odot \odot) was the Measure of the *semibreve*, and of the *minime*.

There were two Sorts of *Prolations*, viz. the *perfect*, and *imperfect*.

The *perfect Prolation*, was marked after the Key, by a Point within a Circle, thus \odot , or within a Semi-circle, thus \odot , and then the *semi-breve* or Round was worth three *minimes* or Whites; wherefore that Circle was commonly accompanied with 3. or $\frac{3}{1}$, or $\frac{1}{3}$. which are the Signs of three Times for each Measure; and which is demonstrated in A, fig. 39.

The *imperfect Prolation* was marked like the *Time*, either by a Circle, thus O, or by a Semi-circle, thus C, both without a Point; and then the *semi-breve* or Round, was worth but two *minimes* or Whites, as is seen in B, fig. 39.

Those Signs are but seldom seen at present, others have been found since less troublesome; though some of them are found sometimes, of which a true Musician must have some Idea at least, in case of Need.

The modern *Italians* have still often in their Musick two Sorts of *Prolations*, very near semblable to that of the Example A, fig. 39. The first, which they call *prolazione maggiore perfetta*, is marked with a \odot and $\frac{3}{1}$;

The second, they call *prolazione minore perfetta*, is marked with a C and $\frac{1}{2}$ or $\frac{1}{3}$, and sometimes with a \odot and $\frac{1}{2}$. but in both the round O, is worth three Times, even without a Point; and its Pause a Measure. The white \odot is worth a Time, and its Pause a Time; and the rest of the Figures in Proportion, as in our Plate fig. 40.

We also call Prolation a Sequel of several Notes or Sounds, either in descending or ascending, on the same Syllable, or Vowels. The Vowels A, E, and O, are very proper for it, but none is to be made on U.

From this I'll pass to the Measure, which is the Interval, or Space of Time, which the Person who beats Time, takes between the raising and falling of his Hand or Foot, in order to conduct the Movement,

sometimes quicker, and sometimes slower, according to the Kind of Musick, or the Subject that is sung or played.

The *Measure*, is that which regulates the Time we are to dwell on each Note.

The ordinary or common *Measure*, is one Second, or sixtieth Part of a Minute, which is nearly the Space between the Beats of the Pulse or Heart; the Systole or Contraction of the Heart answering to the Systole of the Hand, and its Diastole or Dilatation, to the letting it fall. The *Measure* usually takes up the Space that a Pendulum of two Feet and a half long, employs in making a Swing or Vibration.

The *Measure* is regulated according to the different Quality or Value of the Notes in the Piece; by which the Time that each Note is to take up is impressed. The *semi-breve*, for Instance, holds one Rise and one Fall, and this is called the *Measure*, or whole *Measure*; sometimes the *Measure-note*, or *Time-note*; the *minim*, one Rise or one Fall, and the Quaver half a Rise, or half a Fall, there being four Semiquavers in a full *Measure*.

There are *Measures* at two Times or *binary*, at three Times, or *triple*; at four, six, eight, nine, and twelve Times; and *Measures* for all Sorts of Times.

Binary, or *double Measure*, is that wherein the Rise and Fall of Hand are equal.

Ternary, or *tripple Measure*, is that which is beaten in three equal Times, either *simple* or *composed*; the first whereof is made by one Fall of the Hand; the second, by turning it a little aside, and the third in raising it.

The Antients had several Manners to mark or give Notice, that a Measure should be beat at three Times. 1. They had one which wanted no Signs after the Key, or in the Course of the Tune, which is found still in the Works of some Moderns. 2. They had another which had certain Lines after the Key for Signs, but which has been above a Century out of Use. 3. They had several more which I have explained in speaking of Time and Prolation; and which the Moderns have retained in Part, as we'll see by the Sequel.

But towards the Middle of the last Century, so many other Species of *Triples* were invented and put in Use, that to give the Explication thereof with some Order, I am obliged to dispose them under three different Classes, viz. of *simple*, *composed*, and *mixt Triples*.

FIRST CLASS.

Of simple Triples.

I call *simple Triples* those which have but three *simple Times*, i. e. whose Times cannot be sub-divided into three other equal Notes. I find five different Sorts of them in Authors, to mark five Degrees of Slowness or Quickness. The first is that called the *grand Triple*, or *Triple of the Rounds*, or of *three for one*; thus called because the *breves* or *Squares*, and the *semibreves*, or *Rounds*, are predominant in it, and the Measure thereof must be beat *slowly* and *gravely*, so that each Time be consequently greater and longer than those of the other following *Triples*.

Our Antients, and some *Italians* still, have four different Signs to mark the *Tripola maggiore*; according to which they gave it four different Names, as in the Table, fig. 40. *Musick Pl. c.*

Under those four Signs, were wanted three *Semibreves* or *Rounds*, and consequently six *Minimes* or *Whites*, twelve *Semi-minimes* or *Blacks*, &c. to make a *Measure*. All their Difference, therefore, consisted only in the Value of the *Breve* or *Square*, which alone and without a Point was worth *three Times*, under the Signs of the first Column of the Table above-mentioned; and was worth but two Times under the Signs of the second Column; so that to perfect the *Measure*, one was obliged to put a *Point of Augmentation*.

Of those four Signs, the Moderns have retained but this $\frac{3}{1}$ without putting before, either the Circle O, or the Semi-circle C, &c. those two Figures of Arithmetick denoting clearly enough, that three Rounds, instead of one, are wanted for one *Measure*; and that a *Breve* being worth two *Rounds*, is consequently worth by itself two Times, and three when followed by a Point; and the other Figures in Proportion.

We should only observe, 1. That often when there are several *Breves* or *Squares* following one another, whether they be found together or not, they are all worth each three Times or a *Measure*, though they be not punctuated, till one *Round* or two *Whites* come, for then the *Breve* which precedes them is worth but two Times.

2. That when several *Breves* are inclosed between two *Rounds*, or between the Marks of Silence answering to them, the first and last are worth but two Times.

3. That the black Notes, whether they be *round* or *square*, or Lozenge-wise, must be entirely considered as if they were white.

4. That the *Pauses*, or *Marks of Silence*, are worth under that Sign but half their common Value: Therefore the whole *Batoon* is worth two *Measures*; the *semi-batoon* but one *Measure*, one or two *Pauses* but one or two Times of the *Measure*.

Therefore it is proper, and even necessary to mark with a Figure a-top, the Number of *Measures* those *Pauses* are worth, lest one should be mistaken in the Execution.

The second Sort of *simple Triple*, is that called by the Italians, *tripola minore*, or *triple minor*. Our Antients had likewise four different Signs for that Sort of *Triple*, according to which they gave them three different Names; as is seen in the Table, fig. 21.

Under all those Signs are wanted three *minimes*, or *Whites*, and consequently six *black*, or six *white Crotchets*, twelve *Crotchets*, or twelve *double Crotchets*, for a *Measure*. All their Difference therefore consisted only in the Value of the *semi-breve* or *Round*, which under the three Signs of the first Column of the Table above-mentioned, was worth alone, and without the Help of a Point, the three Times of the *Measure*.

Of those four Signs the Moderns have retained but this $\frac{3}{2}$ C, whence in all Appearance it has borrowed its Name of *double Triples*, even without putting before, the Semi-circle C; those two Figures being sufficient to mark that three *Whites*, instead of two, are wanted for a *Measure*; and that a *semi-breve*, or *Round*, having by itself the Value of two *Whites*, is consequently worth two Times and three Times, if it be followed by a Point, and thus in Proportion of the other Figures.

It must be only observed here, 1. That the three first Observations we have lately made on the *Breve* are to be applied in Proportion to the *semi-breve* or *Round*.

2. That often under that Sign, are found especially among the Italians, *white Crotchets* instead of *simple Blacks*, and *white double Crotchets* instead of *simple Crotchets*.

3. That with respect to the *Marks of Silence*, the *Batoon* is worth, as usual, four *Measures*, the *Semi-batoon* two *Measures*, the *Pause* one *Measure*, but the *Semi-pause* is worth here but the Third of a *Measure*; a *Soupir* is worth but the sixth Part thereof; and the *half Soupir* but a twelfth Part, &c.

The third Kind of *simple Triple*, is that called by the Italians, *tripola picciola*, *small Triple*: It is marked thus, $\frac{3}{4}$ C, or simply $\frac{3}{4}$, or more simply 3. Under one of those three Signs three *Blacks* make one *Measure*, whereas four of them are wanted for a *binary Measure*; therefore six *Crotchets*, or twelve *double Crotchets* make likewise a *Measure*; and the *white Simple* is worth two Times, the *white punctuated* three Times, or one *Measure*, &c.

With regard to the *Marks of Silence*, the *Batoon* is worth as usual four *Measures*, the *Semi-batoon* two *Measures*, the *Pause* is worth one *Measure*; but the *half Pause*, which should be worth two Times of the *Measure*, is seldom used, and in lieu thereof are placed two *Soupirs*, which are worth each one Third of a *Measure*, as a *half Soupir* is worth a sixth Part thereof, &c.

When that *Triple* is marked by $\frac{3}{4}$, it is proper for tender Expressions, and the Movement thereof must be moderate, neither *too quick*, nor *too slow*, &c. When marked by a single 3, the Movement thereof is most commonly a little merry; wherefore it is most commonly used for the *Chacones*, *Minuets*, and other merry and lively Dances.

The fourth Kind of *simple Triple*, is that called by the Italians *tripola crometta*, or *Triple of Crotchets*; because, without doubt there is no other Sign but these two

Figures thus C $\frac{3}{2}$ or thus $\frac{3}{4}$, which mark that three *Crotchets* make a *Measure*, whereas eight are wanted in the *binary Measure*; that therefore six *double Crotchets*, and twelve *triple Crotchets*, make likewise a *Measure*; and that a *single Black* is worth two Times, and three Times are a *Measure* when it is punctuated.

Under that Sign the *Batoon*, *Semi-batoon*, and the *Pause*, are worth as usual, 4, or 2, or 1, but the *half Pause* is never used, no more than the *Soupir*, in lieu whereof are put two *Demi-soupirs*, which are worth each one Third of the *Measure*.

Lastly, the fifth Kind of *simple Triple*, is that which the Italians call *tripola semi crometta*, or *Triple of double Crotchets*. Its Sign is composed of these two Numbers thus C $\frac{3}{4}$, or thus $\frac{3}{8}$, which mark that three *double Crotchets* make one *Measure*, whereas 16 of them are wanted in the *binary Measure*: Therefore that six *triple Crotchets*, and one punctuated *Crotchet* make also a *Measure*; that a *single Crotchet* is worth but two Times, &c. for Example, fig. 35.

Under that Sign the *Batoon*, *Demi-batoon*, and the *Pause*, are worth as usual, 4 or 2, or 1, *Measure*; but neither the *half Pause*, nor the *Soupir*, nor the *half Soupir*, are ever used in it; in lieu thereof are put two Quarters of a *Soupir*, &c.

This *Triple*, as is easily seen, is proper for very *quick* and *rapid Expressions*, since each Time of the *Measure* must last no longer than a *double Crotchet* lasts in the *ordinary Measure*.

Note, That those abovementioned are the five Kinds of *simple Triple*, which have been invented, only to mark the different Degrees of *Slowness* or *Quickness*, which must be given to each Time of the *Measure*, as is plainly seen, fig. 37. *Musick Table*.

SECOND CLASS.

Of the composed Triples.

I call *composed Triples*, those which have not only, and are but at three Times, like the *Simples*; but each Time whereof can likewise be sub-divided into three other equal Times or Notes, and are called in general, by the Italians, *nonupla*, and by the French *measure, at nine Times*; though they should be called more properly *double*, or *double Triples*, of which there are but three Sorts in Use.

The *first*, is that called by the Italians *nonupla di semi-minima*, and by the French *Triple of 9 for 4*, or *nine four*; because it has for Sign those two Numbers thus, C $\frac{9}{4}$, or thus $\frac{9}{8}$, which mark that 9 black Notes are wanted in each *Measure*, viz. three at each Time instead of two: Therefore that a *White pointed* is worth a Time; and that being *simple* it is worth but two Thirds of a Time; the *Batoon*, *Demi-batoon*, and the *Pause*, are worth as usual, 4, or 2, or 1 *Measure*; but the *half Pause* is worth but a Time, or a third Part of the *Measure*, and not a half *Measure*: The *Soupir* is worth but a ninth Part thereof, &c. This *Triple* is proper for tender Expressions, and is to be beat moderately, neither too slow or too quick; as in fig. 29.

The *second*, is that which the Italians call *nonupla di crome*, or *fisqui ottava*, and the French *Triple of 9 for 8*, or only *nine eight*; because that *Triple* has for Sign those two Numbers thus, C $\frac{9}{8}$, or thus $\frac{9}{16}$, which mark that there wants *nine Crotchets*, viz. three in each Time, to make up the *Measure*, instead of four. Therefore that a *simple Black* is worth but two Thirds of a Time, and a whole Time when it is pointed, &c. The *Batoon*, *Demi-batoon*, and the *Pause* are worth as in the preceding; but the *Half pause* is never used. The *Soupir* alone is worth a Third, or one of the Times of the *Measure*; the *half Soupir* is worth a ninth Part thereof, &c. that *Triple* is proper for merry Expressions, and ought to be beat *quickly* and *merrily*.

The *third*, is that called by the Italians *nonupla di semi-crome*, and by the French *Triple of 9 for 16*; because it has for Sign those two Numbers, thus C $\frac{9}{16}$, or thus $\frac{9}{32}$; which mark that there wants *nine double Crotchets* for a *Measure*, viz. three at each Time instead of eight; therefore that a pointed *Crotchet* is worth one Time, or one Third of the *Measure*; that being *simple* it is worth but two Thirds of a Time, &c. The *Batoon*, *Semi-batoon*, and

and the Pause, are worth as usual. But the half Pause, and the *Soupir* are never used. The *half Soupir* is worth a Time, or one Third of the Measure, &c. This Triple is proper for very quick and very rapid Expressions. As is seen, fig. 32.

Note, That I have observed already, that we find but these three Kinds of Triples in the Works of the Moderns: But as five other Kinds of simple Triples, have been invented to mark the different Degrees of Slowness or Quickness, which must be given to the Measure; I believe that it would be proper, since, besides, it is very easy to do it, to introduce two other Kinds of *compound Triples*, and add to the three Signs here above $\frac{3}{4}$, $\frac{3}{8}$, $\frac{3}{16}$ these two other Signs $\frac{3}{2}$ and $\frac{3}{4}$. The first whereof could be very well called *Triple of 9 for 1*; because it would have those two Numbers for Signs, thus $\frac{3}{2}$, which would shew, 1. That for a Measure there should be wanted 9 Semi-breves or Rounds, *viz.* three at each Time. 2. That for one Time, a Breve, or Square with a Point should be wanted; because without a Point it would be worth but two Thirds of a Time, &c. 3. That the Batoon would be worth but two Measures; the Semi-batoon one Measure; the Pause one Time of the Measure; and the half Pause one Third of a Time, or a ninth Part of the Measure, &c. That Kind of Triple would be very proper for sorrowful and languishing Expressions, and generally for all those which want a slow Measure, for Instance, fig. 33.

The Second would be called *Triple of 9 for 2*, because it would have those two Numbers for Signs, thus $\frac{3}{4}$; which would shew, 1. That for one Measure, 9 Minims or Whites should be wanted, *viz.* three for each Time. 2. That for one Time there should be wanted a Semi-breve or Round, with a Point, because without a Point it would be worth but two Thirds of a Time, &c. 3. That the Batoon would be worth but two Measures; the Semi-batoon one Measure; the Pause one Time; and the half-Pause one Third of a Time, or a ninth Part of the Measure; as fig. 34. This Triple would be very proper for the Movements which the *Italians* express by the Words *lento*, *adagio*, &c.

THIRD CLASS.

Of Triples mixt.

I call *Triples mixt*, those which participate of two Sorts of Measures, *i. e.* which, for the Manner of beating the Measure thereof, follow, *v. gr.* the binary Measure; and for the Value of their Notes or Figures, follow the ternary Measure. But there are two Sorts of binary Measures, *viz.* a simple one composed of two Times; and one composed which has four Times; which obliges me to divide this Class into two Articles.

ARTICLE I.

Of Triples at two Times.

These we call a *Measure at six Times*, though improperly, for they should rather be called binary Triples, &c. we find but three Kinds of them in Authors; but we have some Reason to add two more to them; therefore, I'll explain them all five in this Article.

The first is that which we could very well call *Triple of 6 for 1*, because it should have for Sign these two Numbers thus, $\frac{3}{2}$, which would shew, 1. That for a Measure there should be wanted six Rounds instead of one, *viz.* three in striking, and three in rising. 2. That one Breve or Square with a Point, should be wanted for one Time; because without a Point it should be worth but two Thirds of a Time, &c. 3. That the Batoon should be worth two Measures; the Semi-Batoon one Measure; the Pause one Time; and the half-Pause a sixth of the Measure, &c. which would be very proper for melancholick and very slow Expressions, &c.

The second Sort is that which could be called *Triple of 6 for 2*; because it would have for Sign those two Numbers, thus, $\frac{3}{4}$, which should shew, 1. That a Measure should have six Minims or Whites instead of two. 2. That a Time should want one Semi-breve or Round,

with a Point; because without a Point it would be worth but two Thirds of a Time, &c. 3. That the Batoon would be worth two Measures; the Semi-batoon one Measure; the Pause one Time, and the Semi-pause one Third of a Time, or a sixth Part of the Measure, &c. which would be very proper to mark the Movements, which the *Italians* call *lento*, *tardo*, *grave*, *adagio*, &c. These two Kinds of Triple, are only proposed to the Publick; but the three following are in Use in the modern Authors.

The third Kind of binary Triple, is that which we call of 6 to 4, because it has for Sign those two Numbers thus, $C \frac{6}{4}$ or $\frac{6}{4}$; which shew, 1. That six black, and therefore twelve Crotchets, *viz.* three black are wanted for each Time, &c. instead of two. 2. That a White with a Point, is worth one Time or three Black; and without a Point is worth but two Thirds of a Time, *i. e.* two Blacks, &c. 3. That the Batoon is worth four Measures; the Semi-batoon two Measures; the Pause one Measure; the half Pause half a Measure (which is often marked by three Minim-Rests) the Minim-Rest is worth a Black, *i. e.* the sixth Part of a Measure, &c. This Triple is commonly used for tender affectuous Motions; for Instance, fig. 38.

The fourth Sort of binary Triple, is that we call of six for eight, because it has for Signs those two Numbers, thus $C \frac{6}{8}$ or $\frac{6}{8}$, which shew, 1. That six Crotchets (and therefore twelve double Crotchets) are wanted for one Measure, *viz.* three Crotchets at each Time, &c. instead of four. 2. That a Black with a Point is worth one Time or three Crotchets; and without a Point two Thirds of a Time. 3. That the Batoon, the Semi-batoon are worth as usual 4, 2, 1 Measure; that the half Pause is worth half a Measure, in lieu whereof are sooner put two half Minim-Rests. Lastly, that the half Minim-Rest is worth one Crotchet, or the Third of a Time, or the sixth Part of a Measure, &c. This Triple is proper for merry, lively, and animated Expressions; and consequently beat pretty quick. For Instance, fig. 39.

The fifth Sort of binary Triple, is that called of six for sixteen; because it has for Sign those two Numbers, thus, $C \frac{6}{16}$ or $\frac{6}{16}$, which shews that there is wanted but six double Crotchets, instead of sixteen for a Measure. 2. That a Crotchet with a Point is worth a Time, and the two Thirds of a Time only when without a Point. 3. That the Batoon, Semi-batoon, and the Pause are worth as usual, 4, 2, 1 Measure; that the half Pause is worth half a Measure; that the Minim-Rest is never used, and seldom the half Minim-Rest, in lieu whereof are placed two Quarters of Minim-Rest, &c. This Triple is for Movements and Expressions of the greatest Rapidity, which the *Italians* mark by the superlative Term *Prestissimo*. For Example, fig. 40.

Note, That I have already observed, that these five Species of Triples are to beat two Times, for which they are called binary Triples; though some Masters of *Musick* mark six Times with the Hand, especially when the Motion is very slow, as are the Signs $\frac{3}{2}$ and $\frac{3}{4}$ (wherefore they have been called *Measures of Triples at six Times*) or when the Motion is so merry, that it would be impossible to mark those six Times with the Hand, they at least mark four of them, *viz.* two long or double, *viz.* the first and third; and two shorter, which are the second and fourth; which is the common Practice of the *Italians*, and by their Example, of those of other Nations, who understand their Business, under the Signs 6, 4, and 6, 8, there is but the Sign 6, and 16. where they are contented to mark two Times with the Hand, the Motion whereof being so rapid, that it is scarce possible to mark distinctly in it, either six or four Times; therefore there should be but that last Sign which could be properly called binary Triple, &c.

To which it may be answered, that in fact, those different Manners of beating the Measure, are reduced to two principal Times; and that if they have been introduced into *Musick*, it is to facilitate the Execution thereof, as to Practice. Fig. 41. is a Table of the Sestuple, or binary Triples.

ARTICLE II.

Of Triples beaten at four Times.

The *Italians* call them by the general Name *Dodecupla*, and the *French* Measures at twelve Times; but they should be rather called Triples at four Times, &c. we commonly find but three Sorts of them in Authors, viz. the twelve four, the twelve eight, and the twelve sixteen; but I'll explain, as in the preceding Articles, five Species of them.

The first is that which could be called in *Italian* *Dodecupla di Semi-brevis*, and in *French*, Triple of 12, for 1, because it should have for Sign those two Numbers, thus $\text{C}^{\frac{1}{2}}$, which would shew, 1. That for one Measure there should be wanted twelve Semi breves or Rounds instead of one; viz. three at each Time, and consequently six Whites at each Time, &c. 2. That a Breve with a Point should be worth one Time, and without a Point only the two Thirds of a Time. 3. That the Batoon should be worth but two Measures, the Semi-batoon one Measure; the Pause one Time; the Semi-pause one Third of a Time, &c. which would be very proper for very melancholick, and slow Expressions, &c. For Example, fig. 43.

The second Species of Triples at four times, is that which could be very well called in *Italian* *Dodecupla di minime*, and by us Triple of 12 for 2. Because it would have for Sign those Numbers, thus $\text{C}^{\frac{1}{2}}$. Which would shew, 1. That 12 Minims or Whites should be wanted for one Measure, 3 at each Time; and therefore 24 Semi-minims or Blacks, &c. 2. That a White pointed should be worth one Time, and not pointed the two Thirds of a Time, &c. 3. That the Batoon should be worth but two Measures; the Semi-batoon but one Measure; the Pause one Time; the Semi-pause the Third of a Time; which would be proper for grave and slow Expressions, &c. For Instance, fig. 44.

The third Species of Triples at four Times, is that which the *Italians* call *Dodecupla di Semi-minime*, and we Triple of 12 for 4. Because it has for Sign those two Numbers, thus $\text{C}^{\frac{1}{4}}$ or $\text{C}^{\frac{1}{2}}$; which shews, that 12 Blacks, instead of 4, are wanted for one Measure, viz. three at each Time, and therefore 24 Quavers instead of 8, &c. 2. That a White pointed is worth one Time; and not pointed, the two Thirds of a Time, &c. 3. That the Batoon, Semi-batoon, and the Pause, are worth as usual 4, 2, 1 Measure. That the half Pause is worth one Time; the Minim-Rest one Third of a Time, or a twelfth Part of a Measure, &c. which is proper for tender and affectuous Expressions, and sometimes for those which are lively and animated, &c. For Instance, fig. 45.

The fourth Species of Triples at four Times, is that which the *Italians* call *dupla di Chrome*, and the *French*, Triple of 12 for 8, because it has those two Numbers for Sign, thus $\text{C}^{\frac{1}{8}}$ or thus $\text{C}^{\frac{1}{2}}$; which shews, 1. That 12 Crotchets or Quavers are wanted for a Measure, viz. three at each Time, therefore 24 double Quavers, &c. 2. That a Black pointed is worth a Time, and not pointed, two Thirds of a Time, &c. 3. That the Batoon, Semi-batoon, and the Pause, are worth as usual 4, 2, or 1 Measure. The half Pause a Time or half a Measure; and the Minim-Rest a Time. Lastly, that the half Minim Rest is worth the Third of a Time, &c. This Triple is very proper for lively and merry Expressions; which notwithstanding the *Italians* use it very often for tender and affectuous Expressions, adding to it the Words *adagio*, *affettuoso*, or some other, for of itself it denotes Mirth. For Instance, fig. 46.

Lastly, the fifth Species of Triple at four Times, is that called by the *Italians*, *Dodecupla di semi crome*, and by us, Triple of 12 for 16; because it has for Sign those two Numbers marked thus $\text{C}^{\frac{1}{16}}$, or thus $\text{C}^{\frac{1}{2}}$; which shews, that 12 Quavers are wanted for a Measure, viz. three at each Time; the Pause is worth as usual 4, 2, and 1 Measure; the half Pause is worth two times, or a half Measure. The Minim-Rest is never used; the half Minim-Rest is worth one Time, and the Quarter of a Minim-Rest, the Third of a Time, &c. This Triple is proper for very quick, and very rapid Expressions; which the *Italians* mark by the super-

lative *Prestissimo*. For Instance, fig. 47.

Note, That from the Triples I'll pass to *Syncope*, called also *Syncopation*.

SYNCOPE signifies the Division of a Note, used when two or more Notes of one Part answer to a single one of the other, as when the Semi-breve of the one answer to two or three Notes of the other.

But to have a right Understanding of the Word *Syncope*, it must be observed first, that every Bar in common Time has two Parts, one of which is when the Hand falls, the other when it rises.

Secondly, that any Note which contains two times, or a Rise and Fall of the Hand, is divisible into two Parts, for the first whereof the Hand goes down, for the last it rises.

Thirdly, that every Note (though of less Value than a Semi-breve) is divisible into two others, the first whereof must be during the first Part of the Measure, or with a Rise or Fall of the Hand, the other Part in the Second.

When Notes do not follow this natural Order, that is, when the first Part is not during the Rise, and the other during the Fall of the Hand; or when the first Part of the Note is not made in the first Part or Instant of the Rise or Fall of the Hand, it is said to be *syncopated*, from *synkopto*, *ferio*, *verbero*, I strike, I beat; thus to distinguish the Time of the Measure; consequently when one or more Notes are placed between two others, which are but half the Value of that in the Middle, the first whereof is made with a Fall, or in the Instant of a Rise or Fall; or when instead of that first Note, there is a Pause of its Length; or if instead of such first Note, there are two equal to it, these may be properly said to be *syncopated*, and are in *Musick* what Feet are in Poetry.

It must also be remarked, that Syncopes are written three Ways; first by a Figure only, which was the Practice of the Antients, till those perpendicular Lines, which we call Bars, were used; when the Note was divided into two others, each of which was its half, they marked it with a Semi-circle, thus \bigcirc , to shew that those make but one: This makes what the *Italians* call *Note legate*, and is used by Reason one of the Notes is in the latter Part of a Bar, and the other in the Beginning of the next following.

The third, which was highly disapproved by the Antients, and which at present is very much used, is when for the Application of some Word, or to give a brisker Motion to the Song, the Notes to parties of the Bar, were free and untied. It often happens, that the first of those two Notes is divided into two others of less Value; and this may be done two Ways; the first is, by adding a Point to the first of the two Notes which form this Subdivision, and following it with another of equal Value with its Point; the second is, when both of them are of equal Length. All these Ways are common in the modern Practice, but should not be used without Necessity.

Syncope is often used in Melody, or in the Course of a Song, in mournful languishing Expressions; sometimes to express Sighs, and very often, on the contrary, in very quick Movements, to excite Joy, then causing certain Leaps or Springs among the Notes proper to that End. But its greatest Use is in Harmony, being, as it were, the Life of it, by giving Means of forming that agreeable Contrast between Concords and Discords, which makes the principal Beauty of the modern Musick; and is that Part of the Science, in which, says M. *Brossard*; we have any Reason to think we excel the Antients.

With Respect to Harmony, there are three Syncopes. The first is when all the Parts *syncope* at the same Time, but without Discords; thinking it enough to move uniformly, contrary to the natural Order of the Measure. This the *Latins* call *Syncope equivocans*, and is not allowed to be any Thing excellent by Judges of Harmony; and therefore is very seldom met with. The second, little better than the first, is when only one of the Parts *syncopes*, and yet without Discord. The *Italians* call it *contrapunto legato*, because the *syncoped* Notes must be bound. The last is, when only one Part *syncopes*, and that to bring in some Discord, and is the *contrapunto syncopato* of the *Italians*.

Note,

Note, That some Observations are to be made on this Syncope, which is a principal. 1. That the Discords must not be on the syncope Note; a Concord there is indispensable, whether perfect, as octave and fifth; or imperfect, as third and sixth, as well major as minor. The fourth indeed, which in the Opinion of some is a Concord, of others a Discord, but more generally allowed both by the antient and modern Theorists, to be a Concord, is often placed on the first Part of the Syncope, especially to form a Cadence. We also find sevenths, ninths, &c. on the first Part of the Syncope; but as these Dissonances must continue on the second Parts also, and the Bass holds on the same Notes, this ought rather to be reckoned Supposition than Syncope.—2. According to the modern Practice, any Discord but the redundant and defective Eights and defective Seconds, may be admitted in the second Part of the Syncope. The Antients, says M. Broffard, only used the ninth, seventh, and second, and sometimes, but very rarely, the false Fifth, and Tritone; and never any other discordant Interval, whether superfluous or defective.—3. The Discord must not rest upon the Syncope more than one Time of the Measure; and if at any Time it be necessary upon any Occasion to divide the second Part of the Syncope into two, the second Note must not be upon the same Degree with the Syncope Note, but on the Degree below it, or that which resolves it into a Concord.—4. For it is not enough to make and prepare a Discord, but it must be resolved, that is, it must be followed, either mediately, or immediately by a Concord; and first, this must be done in the Time of the Measure following the Syncope; secondly, the Part that Syncope must never rise, but on the contrary must fall on the Degree immediately below the syncope Note; never lower, for that is the Sound that resolves the Discord.—5. We say mediately, because they often fall on the Third, after having passed a false Fifth, before resolving the syncope Discord; some Time before falling on the Third, a syncope Fourth is passed, to which the false Fifth stands as a Preparation.—6. The third Rule above is in all Appearance evaded two Ways in modern Practice; the first is, dividing the third Part of the syncope Note into two, three, or more of less Value, before falling on the Note which resolves it; the second is, by dividing the second Part of the Syncope into two equal Parts, the first whereof rests on the same Degree with the syncope Note; the second (which may be divided in any Number of less Value) rises or falls to one of the Chords in the Accompaniment of the Discord, before it comes to the Note which resolves it.

The following is a Table from *Documenti Armonici di Angelo Berrardi*, which shews at once what the Concorde are, that resolve each Distance the more naturally, whether the upper or lower Part of the Syncope.

| When the treble or upper Part syncopes. | When the Bass or lower Part syncopes. |
|---|---------------------------------------|
| The 2d is resolved by Unison. | The 2d is resolved by the 3d. |
| The 4th by the 3d. | The 4th by the 5th. |
| The 7th by the 5th or 6th. | The 7th by the 8th. |
| The 9th by the 8th. | The 9th by the 10th. |
| The 11th by the 10th. | The 11th by the 12th. |

When two successive Notes of equal Value, as to Time, are used, one of which being a Discord, supplies the other a Concord, that's called *Supposition*.

There are several Kinds of *Supposition*. The first, when the Parts proceed gradually from Concord to Discord, or *é contra* from Discord to Concord, the intervening Discord serving only as a Transition to the following Concord.

Another Kind is, when the Parts do not proceed gradually from Discord to Concord, and *vice versa*, but descend to it by the Distance of a Third.

A third Kind like the second, is, when the rising to the Discord is gradual, but the descending from it to the following Concord is by the Distance of a Fourth.

A fourth Kind very different from all the rest, is, when the Discord falls on the accented Part of the Mea-

sure, and the rising to it is by the Interval of a Fourth, in which Case it is absolutely necessary to follow it immediately by a gradual Descent into a Concord, which has just been heard in the Harmony, to make the preceding Discord pass without Notice, and only seem a Transition into the Concord.

M. Broffard lays us down the following Rules of *Supposition*: In the first he says, the Notes of the Part that moves, while the other holds out, or continues on a Sound, must proceed by conjoint Degrees; if they proceed otherwise, that is, by Disjoints, they must be all Concorde.

2. If two Notes are played to one of another Part, the first must be Concord, the second only may be Discord, which nevertheless must be followed by a Concord in conjoint Degrees, either rising or falling.

3. If four Notes are played to one of another Part, as four Crotchets to a Semibreve, only the second and fourth are allowed to be Discords; and therefore the first and third, by a gradual Ascent or Descent, are to be Concorde. The first of every two being reckoned long or accented, must be Concord; the second and fourth short or unaccented, may be Discord.

Note, That *Accent* in Musick, is a certain Modulation, or working of the Sounds to express the Passions, either naturally by the Voice, or artificially by Instruments. Every Bar or Measure is divided into accented and unaccented Parts; the accented are the Principal, being those chiefly intended to move and affect; 'tis on those the Spirit of Musick depends. The Beginning and the Middle, or the Beginning of the first Half of the Bar, and the Beginning of the latter Half thereof in common Time, and the Beginning, or first of three Notes in triple Time, are always the accented Parts of the Measure. Again, in common Time the first and third Crotchet of the Bar, are on the accented Part of the Measure. In triple Time, where Notes go always by three and three, that which is in the Middle of every three is unaccented, the first and last accented; but the Accent of the first is so much stronger, that in many Cases the last is accounted as if it had no Accent. This accented and unaccented Part of a Measure answers to what the Italians call *tempo buono*, and *cattivo*. The Harmony is always to be full, and void of Discords in the accented Parts of the Measure; by Discords, we mean Discords in conjoint Degrees, which are commonly called passing Notes; for Discords by proper Preparation and Resolution, are absolutely necessary, and must be used therein. In the unaccented Parts this is not so necessary, Discords by conjoint Degrees there passing without any great Offence to the Ear.

4. When three Notes are played to one, they must all be of equal Value, as in the Measure $\frac{3}{4}$, or $\frac{3}{8}$, &c. The second must, and sometimes, though very rarely, the third may be Discord, and the first always Concord. If the first of these three be as long as the two others, it must be Concord (very rarely Discord) the second and third may be Discord, or either of them at Pleasure. If the last be as long as the two first, the first of them must be Concord, the second Discord, and the long Note may be either as Occasion serves.

Lastly, if these three Notes be of equal Value, but preceded by a Pause equal to one of them, the first of those left may be a Discord, because the Pause is reckoned in the Place of the Concord; for Example, fig. 29.

I know, says that Author, these Rules are not so regularly observed as they ought; for sometimes when four Crotchets are played to a Semibreve, the second is made Discord, though not proceeding by conjoint Degrees, the third and fourth Concorde; sometimes the first and third are Concorde, the second and fourth Discords, or even the first, second, and fourth Concorde, and the third only a Discord. Very often, continues he, four Semiquavers, though in different Degrees of Time, are reckoned for one Crotchet; but 'tis the Quaker's of the Motion, or the Necessity of favouring some Expression, that in some Measure excuses these Irregularities, and the less common they are, the better.

Note, That to dispose to Practice all the Rules here-

fore described, into Airs, Songs, &c. either in one or more Parts, to be sung by a Voice, or played on Instruments, is the practical Part of Musick, or the Art of *Composition*.

Zarlino defines *Composition*, the Art of joining and combining Concords and Discords together.

Under *Composition* are comprehended the Rules, 1. Of *Melody*, or the Art of making a single Part, that is, contriving and disposing the simple Sounds, so as that their Succession and Progression may be agreeable to the Ear.

2. Of *Harmony*, or the Art of disposing and concerting several single Parts together, so as that they make one agreeable Whole.

It may be here observed, that *Melody* being chiefly the Business of the Imagination, the Rules of its Composition serve only to prescribe certain Limits to it, beyond which the Imagination, in searching out the Variety and Beauty of Airs, ought not to go. But *Harmony* being the Work of the Judgment, its Rules are more certain and extensive, and more difficult in Practice. In the Variety and Elegancy of the *Melody*, the Invention labours a great deal more than the Judgment, so that Method has little Place; this must not be understood that the Judgment is discarded, for good *Melody* requires a true Observation of the *Harmony*; a Person indeed unskilled in Musick may make a Piece of *Melody*, which by mere Chance may be good, but a Person of good Judgment cannot often err. In *Harmony*, the Invention has not so much to do, for the *Composition* is conducted from a nice Observation of the Rules of *Harmony*, which must yet in some Sort be assisted by Observation.

HARMONY therefore, is the agreeable Result or Union of several musical Sounds, heard at one and the same Time, or the Mixture of divers Sounds, which together have an Effect agreeable to the Ear.

Among the Antients however, as also sometimes among the Moderns, *Harmony* is used in the strict Sense of Consonance, and it is equivalent to Sympathy.

The Words *Concord* and *Harmony* do really signify the same Thing, though Custom has made a little Difference between them; *Concord* is the agreeable Effect of two Sounds in Consonance, and *Harmony* the Effect of any greater Number of agreeable Sounds in Consonance.

Again, *Harmony* always implies Consonance, but *Concord* is also applied to Sounds in Succession; though never where the Terms can stand agreeably in Consonance.

The Antients, says *M. Malcom*, seem to have been entirely unacquainted with *Harmony*, the Soul of modern Musick, in all their Explications of the *Melopœia*, they say not a Word of Concert, or the *Harmony* of Parts.

We have Instances indeed, continues that Author, of their joining several Voices or Instruments in Consonance; but then those Voices or Instruments are not so joined, as that each had a distinct and proper *Melody*, so made a Succession of various Concords, but were either Unisons or Octaves in every Note; and so all performed the same individual *Melody*, and constituted one Song.

When the Parts differ not in the Tension of the whole, but in the different Relations of the successive Notes, 'tis this that constitutes the modern Art of *Harmony*.

Harmony is well defined the Sum of Concords, arising from a Continuation of two or more Concords; *i. e.* three or more simple Sounds striking the Ear altogether, and different Compositions of Concords make different *Harmony*.

To understand the Nature, and to determine the Numbers and Preference of *Harmonies*, it is to be considered, that in every compound Sound, where there are not more than three simple ones, there are three Kinds of Relations, *viz.* primary Relation of every simple Sound to the fundamental or gravest, whereby they make different Degrees of Concord with it; the mutual Relations of the acute Sounds, each with the other, whereby they mix Concord or Discord into the Compound; and the secondary Relation of the whole, whereby all the Terms unite their Vibrations, or coincide more or less frequently.

Suppose, *e. g.* four Sounds, A, B, C and D, whereof

A is the gravest, B the next, then C and D the acute; here A is the fundamental, and the Relations of B, C, and D, are primary Relations: So if B be a Third greater above A, that primary Relation is 4:5; and if C be a Fifth to A, that primary Relation is 3:2; and if D be an Octave to A, that is 2:1: for the mutual Relations of the acute Terms, B, C, D, they are had by taking primary Relations to the Fundamental, and subtracting each lesser from each greater, thus B to C is 5:6, So a Third lesser; B to D, 5:8, a Sixth lesser, &c. And lastly, to find the secondary Relations of the whole, seek the least common Dividend to all the lesser Terms or Numbers of the primary Relations, *i. e.* the least Number that will be divided by each of them exactly, this is the Thing sought; and shews that all the simple Sounds coincide after so many Vibrations of the Fundamental, as the Number expresses.

So in the preceding Example the lesser Terms of the three primary Relations are 4, 2, 1, whose least common Dividend is 4, consequently at every fourth Vibration, of the Fundamental, the Whole will coincide. Now *Harmony*, we have observed, is a compound Sound, consisting of two, three, or more simple Sounds.

Its proper Ingredients are Concords; and all Discords, at least in the primary and mutual Relations, are absolutely forbidden. 'Tis true, Discords are used in Musick, but not of themselves simply, but to set off the Concord by their Contrast and Opposition.

Hence every Number of Concords being proposed to stand in primary Relations, with a common Fundamental; we discover whether or no they constitute perfect *Harmony*, by finding their mutual Relations.

Thus, suppose the following Concords, or primary Relations, *viz.* a greater Third, Fifth, and Octave given, their mutual Relations are all Concord, and therefore may stand in *Harmony*; for the greater Third and Fifth are to one another as 5:6, or lesser Third; the greater Third and Octave as 5:8, or lesser Sixth; and the Fifth and Octave, as 3:4, or a Fourth. But if fourth, fifth, and Octave be proposed, 'tis evident they cannot stand in *Harmony*; by Reason, betwixt the fourth and fifth there is a Discord, *viz.* the Ratio 8:9. Again, supposing any Numbers of Sounds which are Concord each to the next, from the lowest to the highest; to know, if they can stand in *Harmony*, we must find the primary and all the mutual Relations, which must be all Concord. To let any Number of Sounds be as 4:5, 6:8, they stand in *Harmony*, by Reason each to each is Concord; but the following ones cannot, *viz.* 4:6:9, by Reason 4, 9 is a Discord.

The necessary Conditions of all *Harmony* then are Concord in the primary and mutual Relations; on which Footing a Table is easily formed of all the possible Varieties: But, to determine the Preference of *Harmonies*, the secondary Relations are to be considered, the Perfection of *Harmonies* depends on all the three Relations; it is not the best primary Relation that makes the best *Harmony*; for then a fourth and a fifth, must be better than a fourth and a sixth; whereas the first two cannot stand together, because of the Discord of the mutual Relation; nor does the best secondary Relation carry it, for then would a fourth and a fifth, whose secondary Relation with one common Fundamental, is six, be better than a third and fifth, whose secondary Relation is ten, but there also the Preference is due to the better mutual Relations; indeed the mutual Relations depend on the primary, though not so as that the best primary shall always produce the best mutual Relations. However, the primary Relations are of the most Importance; and together with the Secondary, afford us the following Rules for determining the Preference of *Harmonies*.

To wit, comparing two *Harmonies* together that have an equal Number of Terms, that which has the best primary and secondary Relations, is the most perfect, but in Cases where the Advantage lies in the primary Relation of the one, and in the Secondary of the other, we have no certain Rule; the primary are certainly the most considerable; but how the Advantage in this ought to be proportioned to the Disadvantage of the other, or *vice versa*, we know not. So that a well tuned Ear must be the last Resort in these Cases.

HARMONY is divided into *Simple* and *Compound*.

Simple HARMONY is that to which there is no Concord to the Fundamental above an Octave.

The Ingredients of *Simple Harmony*, are the seven original simple Concords, of which there can be but eighteen different Combinations that are *Harmony*; which are given in the following Table from Mr. *Malcolm*.

The TABLE of Simple Harmonies.

| Secondary Relations. | | | | | | Secondary Relations. | | | | | |
|----------------------|-----|---|----------|-----------|--|----------------------|----------|-----------|-----|--|--|
| 5th | 8ve | 2 | 3d grt. | 5th | | 4 | 3d grt. | 5th | 8ve | | |
| 4th | 8ve | 3 | 3d lefs. | 5th | | 10 | 3d lefs. | 5th | 8ve | | |
| 6th greater | 8ve | 3 | 4th | 6th grt. | | 3 | 4th | 6th grt. | 8ve | | |
| 3d greater | 8ve | 4 | 3d grt. | 6th lefs. | | 12 | 3d grt. | 6th grt. | 8ve | | |
| 3d lefs. | 8ve | 5 | 3d lefs. | 6th lefs. | | 5 | 3d lefs. | 6th lefs. | 8ve | | |
| 6th lefs. | 8ve | 5 | 4th | 6th lefs. | | 15 | 4th | 6th lefs. | 8ve | | |

These are all the possible Combinations of the Concords that are *Harmony*; for the Octave is compounded of a fifth and a fourth, or a sixth and a third, which have the Variety of greater and lesser; out of these are the first six *Harmonies* composed: Then the fifth being composed of a greater and lesser Third, and the sixth of a Fourth and Third; from these proceed the next six of the Table: Then an Octave, joined to each of these six, makes the last six of the Table.

The Perfection of the first twelve is according to the Order of the Table; of the first six each has an Octave, and their Preference is according to the Perfection of that other lesser Concord joined unto the Octave. For the next six the Preference is given to the two Combinations with the fifth, whereof that which has the third greater is the last. For the last six they are not placed last, because the least perfect, but because they are the most complete, and are the Mixture of the other twelve with each other; in Point of Perfection they are plainly preferable to the preceding six, as having the same Ingredients with one Octave more.

Compound HARMONY is that which to the *Harmony* of an Octave adds that of another. The Varieties thereof are easily found out of the Combinations of the simple *Harmonies* of several Octaves.

HARMONY again may be divided into that of Concords, and that of Discords.—The first is that which we have hitherto considered, wherein nothing but Concords are admitted.—The second is that wherein Discords are used, and mixed with Concords.

The first is also called *simple Counterpoint*, and the second *figurative Counterpoint*.

Simple Counterpoint consists of the imperfect, as well as perfect Concords, and may be therefore denominated perfect or imperfect, according as the Concords are whereof it is composed: Thus the Harmony arising from a Conjunction of any Note with its fifth and Octave is perfect, but with its third and sixth imperfect; notwithstanding this the Composition is perfect, 'tis the particular Concords only that are called imperfect.

Now to dispose the Concords, or the natural Notes, and their Octaves in any Key in a *simple Counterpoint*, observe with Regard to the Distinction, into perfect, or imperfect *Harmony*, this general Rule, viz. to the Key to the fourth, and to the fifth, perfect Harmony must be joined; to the second, third, and seventh, an imperfect Harmony is indispensable; to the sixth, either a perfect or imperfect Harmony, but when you keep the Keys, an imperfect Harmony is given the sixth.

In the Composition of two Parts, observe, that though a Third appears only in the Treble, or the fourth and fifth, yet the perfect Harmony of the fifth is always supposed, and must be supplied in the Accompaniments of the Thorough Bass to those fundamental Notes.

More particularly, in Compositions of two Parts the Rules are; that the Key may have either its Octave, or fifth, or third; the fourth and fifth may have either their respective Thirds, Fifths, or Octave; the second, sixth, the third and seventh may have their respective Thirds or Sixths; and the last on many Occasions may have its false Fifth as a passing Note, which Rules hold the same in flat and sharp Keys.

For the Rule of *Counterpoint*, with Regard to the Succession of Concords, it must be observed, that, as much as can be, the Parts may proceed by a contrary Motion

i. e. the Bass may descend where the Treble ascends, and vice versa; the Parts moving either upwards or downwards the same Way; two Octaves or two Fifths never follow one another immediately; two Sixths never succeed each other immediately. Whenever the Octave or Fifth is to be made Use of, the Parts must proceed by a contrary Motion, except the Table moves to such an Octave or Fifth gradually. If in a sharp Key the Bass descend gradually from the fifth to the fourth, the last in that Case, must never have its proper Harmony applied to it, but the Notes that were Harmony in the preceding fifth, must be continued on the fourth; Thirds and Fifths may follow one another, as often as one has a Mind.

The *figurative Counterpoint* is of two Kinds; in one Discords are introduced occasionally as passing Notes, serving only as Transitions from Concord to Concord: in the others, the Discord bears a chief Part in the Harmony.

For the first, nothing but Concords are to be used in the accented Parts of the Measure, i. e. not by the gradual Progression, but by proper Preparation and Resolution Discords are absolutely necessary. In the unaccented Parts Discords may pass without any Offence to the Ear. This is called by most Authors *Supposition*; because the transient Discord always supposes a Concord following it; which is of infinite Service in Musick.

For the second, wherein Discords are used as a solid and substantial Part of the Harmony, the Discords that have Place are the fifth, when joined with the sixth, to which it stands in Relation of a Discord; the fourth when joined with the fifth; the ninth, which is the Effect of the second and seventh, and the second and fourth.

These Discords are introduced into Harmony with due Preparation, and are to be succeeded by Concords, which is called the Resolution of Discords.

The Discord is prepared by first substituting it in the Harmony in the Quality of a Concord; that is, the same Notes which become the Discord are first Concord, to the Bass Note immediately preceding that to which it is a Discord. The Discord is resolved by being immediately succeeded by a Concord, descending from it by the Distance only of a second greater or second less.

As the Discord make a substantial Part of the Harmony, so it must always possess an unaccented Part of the Measure, by gradual Descent, but when prepared and resolved 'tis necessary on the accented Part.—Now, to introduce Discords into Harmony, it must be considered what Concord may serve for their Preparation and Resolution; the fifth, then, may be prepared either by our Octave, Fifth, or Third; and resolved either by third or sixth. The fourth may be prepared in all Concords, and may be resolved into the sixth, third, or Octave. The ninth may be prepared in all Concords, except an Octave; and may be resolved into third, sixth, or Octave. The seventh may be prepared in all Concords, and resolved into third, sixth, or fifth. The second and fourth are used very differently from the rest, being prepared and resolved into the Bass; but what's *Concord*, what's *Discord*; and what's *Octave*?

CONCORD and Harmony are in Effect the same Thing, though Custom has applied them differently. As *Concord* expresses the agreeable Effect of two Sounds in Consonance, so *Harmony* expresses the Agreement of a greater Number of Sounds in Consonance. Add that *Harmony* always implies Consonance, but *Concord* is sometimes applied to Succession; whence it is, that Dr. *Holder*, and some other Writers use the Word *Consonance* for what we call *Concord*.

Unisonance, then, being the Relation of Equality between the Tune of two Sounds, all Unisons are *Concords* in the first Degree; but an Interval being a Difference of Tune, or a Relation of Inequality between two Sounds, becomes a *Concord* or *Discord*, according to the Circumstances of that particular Relation. Indeed some restrain *Concord* to Intervals, and make a Difference of Tune essential thereto; but this is precarious. Mr. *Malcolm* thinks, that as the Word implies Agreement, 'tis applicable to Unisons in the first Degree.

'Tis not easy to assign the Reason or Foundation of Concordance. The Differences of Tune, we have

ready observed, take their Rise from the different Proportions of the Vibrations of the sonorous Bodies, *i. e.* the Velocity of those Vibrations in their Recourses; the more frequent those Vibrations are, the more acute the Tune, and *vice versa*.

But the essential Difference between Concord and Discord lies deeper; there does not appear any natural Aptitude in the two Sounds of a Concord to determine it to give a pleasing Sensation, more than in the two Sounds of a Discord. The different Effects are merely arbitrary, and must be resolved into the divine good Pleasure.

We know by Experience, what Proportions and Relations of Tune afford Pleasure, and what not; and we know also, how to express the Differences of it, by the Proportions of Numbers. We know what it is that pleases us, though we don't know why. We know, *v. g.* that the Ratio of 1, 2, constitutes Concord; and 6, 7, a Discord; but on what original Grounds agreeable or disagreeable Ideas are connected with those Relations, and the proper Influence of the one on the other, is above our Reach.

But by Experience we know, that the following Ratios of the Lengths of Chords are all Concord, *viz.* 2:1, 3:2, 4:3, 5:4, 6:5, 5:3, 8:5; that is, take any Chord for a Fundamental, which shall be represented by the Number 1, and the following Divisions thereof will be all Concord with the whole, *viz.* 1, 2, 3, 4, 5, 3, 5,

so that the distinguishing Character between Conords and Discords, must be looked for in these Numbers, expressing the Intervals of Sounds; not abstractedly in themselves, but as expressing these Numbers of Vibrations.

Now Unisons are in the first Degree of Concord, or have the most perfect Likeness or Agreement of Tune, and therefore have something in them accessory to that Agreement, which is found less or more in every Concord; but as Concord implies a Difference of Tune, they may not be properly so called. 'Tis not true, that the nearer two Sounds come to an Equality of Tune, the more Agreement they have; therefore it is not in the Equality and Inequality of the Numbers that this Agreement lies.

Further, if we consider the Number of Vibrations made in any given Time, by two Chords of equal Tune, on the Principle laid down they are equal, and therefore the Vibrations of the two Chords coincide or commence together as frequently as possible; that is, they coincide at every Vibration; in the Frequency of which Coincidence, or united Mixture of the Motion of the two Chords, and of the Undulations of the Air, occasioned thereby, it is that the Differences of the Conords and Discords must be sought.

Now the nearer the Vibrations of two Strings approach to a Coincidence as frequent as possible, the nearer they should approach the Condition, and consequently the Agreement of Unisons, which agrees with Experience. For if we take the natural Series, 1, 2, 3, 4, 5, 6, and compare each Number to the next, as expressing the Number of Vibrations in the same Time of two Chords, whose Lengths are reciprocally as those Numbers, the Rule will be found exact, for 1:2, is better than 2:3, after 6 is insufferable; the Coincidence being so rare, though there are other Ratios that are agreeable, besides those found in the continued Order, *viz.* 3, 5, 5, 8, which, with the preceding five, are all the conording Intervals, within or less than an Octave, or 1, 2, *i. e.* whose acutest Term is greater than the fundamental. On this Principal, 3, 5, will be preferable to 4, 5, because being equal in the Number of Vibrations of the acuter Term, there is an Advantage on the Side of the fundamental in the Ratio 3, 5, where the Coincidence is made at every third Vibration of the fundamental, and every fifth of the acute Term; so also the Ratio 5, 8, is less perfect than 5, 6; because the Vibrations of each Fundamental are equal, yet in the Ratio 5, 6, the Coincidence is at every sixth Vibration of the acute Term, and only at every eighth in the other Case.

Thus we have a Rule for judging of the Preference of Conords, from the Coincidence of their Vibrations; agreeable to which Rule, they are disposed in the Order

of the following Table, in which the Names of the Conords in Practice, the Ratio of their Vibrations, the Length of their Chords, and the Number of the Coincidences in the same Time are expressed.

| The TABLE of Conords. | | | |
|--------------------------|----------|---------------|----|
| Ratio's of Vibrations. | | Coincidences. | |
| | Grave | Acute | |
| | Terms. | | |
| Unison, | 1 | 1 | 0 |
| Octave, 8ve, | 2 | 1 | 16 |
| Fifth, 5th, | 3 | 2 | 30 |
| Fourth, 4th, | 4 | 3 | 20 |
| Sixth greater, 6th grt. | 5 | 3 | 20 |
| Third greater, 3d grt. | 5 | 4 | 15 |
| Third lesser, 3d lesser, | 6 | 5 | 12 |
| Sixth less, 6th lesser, | 8 | 5 | 12 |
| | Grave | Acute | |
| | Lengths. | | |

Though the Order be settled by Reason, yet it is confirmed by the Ear. On this Bottom, Conords must still be more perfect, as they have the greater Number of Coincidences with Regard to the Number of the Vibrations of both Chords; and where the Coincidences are equal, the Preference will fall on that Interval, whose acutest Term has fewest Vibrations in each Coincidence; which Rule however, is in some Cases contrary to Experience; and yet it is the only Rule discover'd.

F. Merfene, indeed, and after him Kircher, gives us another Standard for settling the comparative Perfection, with Regard to the Agreement of the Extrems in Tune: And 'tis this. —

'The Perception of Concordance, say they, is nothing but the comparing of two or more different Motions, which at the Time affect the auditory Nerve; now we cannot make a certain Judgment of Consonance till the Air be as often struck in the same Time by two Chords, as there are Units in each Number expressing the Ratio of that Concord, *v. g.* we cannot perceive a fifth, till two Vibrations of the one Chord, and three of the other are accomplished together; which Chords are in Length as 3 to 2; the Rule then is, that those Conords are the most simple and agreeable, which are generated in the least Time, and those on the contrary, the most compound and harsh, which are generated in the longest Time.

'For Instance, let 1, 2, 3, be the Length of three Chords, 1, 2, is an Octave; 2, 3, is a fifth; and 1, 3, an octave and fifth compounded, or a twelfth; the Vibrations of Chords being reciprocally as their Lengths, the Chord 2 will vibrate once, while the Chord 1 vibrates twice, and then exists an octave; but the twelfth does not yet exist, because the Chord 3 has not vibrated once, nor the Chord 1, thrice, which is necessary to form a twelfth.

'Again, for generating a fifth, the Chord 2 must vibrate twice, and the Chord 3 twice, in which Time the Chord 1 will have vibrated six Times; and thus the octave will be thrice produced, while the twelfth is only twice produced, the Chord 2 uniting its Vibrations sooner with the Chord 1, than with the Chord 3, and they being sooner Consonant, than the Chord 1 or 2 with that 3.'

Whence, that Author observes, many of the Mysteries of the Harmony relating to the Performance of harmonious Intervals, and their Succession, is easily deduced.

But this Rule, by examining it by the other Instances, M. Malcolm has shewn defective, as it does not answer in all Positions of the Intervals, with Respect to each other; but a certain Order wherein they are to be taken, being required, and being no Rule with Respect to the Order that will make this Standard answer to Experience in every Case; so that at last we are left to determine the Degrees of Concord by Experience and the Ear.

Not but that the Degrees of Concord depend much on the more or less frequent uniting the Vibrations, and the Ear being more or less uniformly moved, as above; for that the Mixture, or Union of Motion is the true Principle, or at least the chief Ingredient in Concord, is evident; but because there seems to be something further in the Proportion of the two Motions, necessary to be known, in order to fix an universal Rule for

for determining all the Degrees of *Concord*, agreeable to Sense and Experience.

The Result of the whole Doctrine is summed up in this Definition; *Concord* is the Result of a frequent Union of Coincidence of the Vibrations of two sonorous Bodies, and by Consequence the undulating Motions of the Air, which being caused by the Vibrations, are like and proportional to them, which Coincidence, the more frequent it is, with regard to the Number of Vibrations of both Bodies, performed at the same Time, *ceteris paribus*, the more perfect is that *Concord*, till the Rarity of the Coincidence, in respect to one or both the Motions, commence *Discords*.

Concords are divided into *simple*, or *original* and *compound*.

A *simple* or *original* *CONCORD*, is that whose Extremes are at a Distance less than the Sum of any two other *Concords*.

On the contrary, a *compound Concord* is equal to two or more *simple* *Concords*.

Other Masters of *Musick* state the Division thus, an Octave 1 : 2, and all the other inferior *Concords* above expressed, are *simple* or *original Concords*; and all greater than an Octave, are called *compound Concords*, as being composed of, and all equal to the Sum of one or more Octaves, and some *simple Concord* less than an Octave, and usually in Practice denominated from that *simple Concord*.

As to the Composition and Relations of the original *Concords*, by applying to them the Rules of the Addition, and Subtraction of Intervals, they will be divided into *simple* and *compound*, according to the first and more general Notion, as in the following Table.

| <i>Simple Concords.</i> | <i>Compound Concords.</i> | <i>Octave composed.</i> |
|-------------------------|---------------------------|---|
| 5 : 6 a 3d less | 5th | of { 5th and 4th. 6 gr. 3d less or 3d 3d less 4th. (gr. |
| 4 : 5 a 3d gr. | 6th less. | |
| 3 : 4 a 4th. | 6th gr. | |

The Octave is not only the first *Concord* in point of Perfection, the Degrees of whose Extremities are greatest and nearest the Unison, inasmuch that when sounded together, 'tis impossible to perceive two different Sounds, but it is also the greatest Interval of the seven original *Concords*, and as such contain all the less, which derive their Sweetness from it as they arise more or less out of it directly; and which decrease gradually from the Octave to the lesser Sixth, which has but a small Degree of *Concord*.

What is very remarkable, is the Manner wherein these less *Concords* are found in the Octave, which shews their mutual Dependencies.

The Octave by mediate Division resolves itself into a Fourth and a Fifth; the Fifth again by immediate Division, resolves itself into the two Thirds; the two Thirds are therefore found by Division, though not by mediate Division, and the same is true of the two Sixths. Thus do all the original *Concords* arise out of the Division of the Octave, the Fifth and Fourth mediately and directly, the Thirds and Sixths immediately.

From the Perfection of the Octave arises this remarkable Property, that it may be doubled, and yet still preserve *Concord*, that is, the Sum of two or more Octaves, are *Concords*, though the more compound will be gradually less agreeable; but it is not so with any other *Concord* less than Octave, the double, &c. whereof are all *Discords*.

Again, whatever Sound is *Concord* to one Extreme of the Octave, is *Concord* to the other also; and if we add any other *simple Concord* to an Octave, it agrees to both its Extremes; to the nearest Extreme it is a *simple Concord*, to the furthest a *compound* one.

Another Thing observable in this System of *Concords* is, that the greatest Number of Vibrations of the Fundamental cannot exceed five; or that there is no *Concord* wherein the Fundamental makes more than five Vibrations to one Coincidence with the acute Term. It may be added, that this Progress of *Concords* may be carried on to greater Degrees of Composition, even in *infinitum*, but the more compound the less agreeable. So a single Octave is better than a double one, and that than a triple one; and so of the Fifths and other *Concords*, three or four Octaves is the greatest Length we go in ordinary Practice; the old Scales went but two, no

Voice or Instrument will go agreeably above four.

As *Concords* are denominated harmonical Intervals, so may *Discords* be made unharmonious ones.

Discords are distinguished into concinnous and unconcinnous Intervals: The concinnous, called by the Antients *Emmeli*, are such as are apt or fit for *Musick*, next to, and in Combination with *Concords*.

These are Relations, which in themselves are neither very agreeable nor disagreeable, and have only a good Effect in *Musick* by their Opposition, as they heighten, and illustrate the more natural and essential Principle of the Pleasure we seek for; as by their Mixture and Combination with them, they produce a Variety necessary to our being better pleased.

Notwithstanding this, they are still called *Discords*, as the Bitterness of some Things may help to set off the Sweetness of others, and still be bitter.

The inconcinnous *Discords*, by the Antients called *Ecmeli*, are such as never are chose in *Musick*, as having too great a Harshness in them, though even the greatest *Discord* is not without its Use.

The essential Principles of Harmony, harmonical Intervals or *Concords* are but few, in Number only eight, the indefinite Numbers of other Ratios are all *Discords*. Hence Mr. *Malcolm* shews the Necessity of taking some of the less untoward of these *Discords* into the System of *Musick*. In order to this, he considers the Effect of having none but harmonical Intervals therein.

1. With respect to a single Voice, if that should move always from one Degree to another, so as every Note or Sound to the next, were in the Ratio of some *Concord*, the Variety which is the Life of *Musick*, would soon be exhausted; for to move by no other than harmonical Intervals would not only want Variety, and so weary us with a tedious Repetition of the same Things, but the very Perfection of such Relation of Sounds would clog the Ear, in the same Manner as sweet and luscious Things do the Taste; which, for that Reason, are artfully seasoned with the Mixture of four and bitter.

2. With respect to *Musick* in Parts, that is, where two or more Voices join in Consonance, the general Rule is, that the successive Sound of each be so ordered, that the several Voices shall be all *Concords*.

Now there ought to be a Variety in the Choice of those successive *Concords*, and also in the Method of their Succession; all which depend on the Movement of the single Parts: So that if they could only move in an agreeable Manner, by harmonical Distances, there are but few different Ways wherein they could move from *Concord* to *Concord*; and hereby we should lose much of the Ravishment of Sounds in Consonance. And to this Part then, the Thing demanded is a Variety of Ways, whereby each single Voice, or more in Consonance, may move agreeably in the successive Sounds, so as to pass from *Concord* to *Concord*, and meet in every Note in the same or a different *Concord*, from what they stood in at the last Note.

In what Cases, and for what Reason, *Discords* are allowed, the Rules of Composition must teach; but only joining these two Considerations, &c. we find how imperfect *Musick* would be, without any Intervals than *Concords*.

Besides the concinnous *Discords* used designedly in *Musick*, there are several other discord Relations, which happen unavoidably in a Kind of accidental and indirect Manner. Thus in the Succession of several Notes, there are to be considered not only the Relations of those which succeed others immediately, but also of those, betwixt which others intervene. Now the immediate Succession may be conducted so as to produce Melody; and yet among the distant Notes, there may be very gross *Discords*, that would not be tolerable in mediate Succession, and far less in Consonance. The taking away one Species, *e. gr.* that with the greater Third, and marking the Degree between each Term and the next; and though the Progression be melodious, as the Terms refer to one common fundamental, yet there are several *Discords* among the mutual Relations of the Terms, *e. gr.* from the fourth to the seventh greater, is 32 : 45; and from the second greater to the fourth greater, is 27 : 40; and from the second greater to the fourth, is 27 : 32; all *Discords*.

The Species of Counterpoints, wherein there is a Mix-

ture of Discords, is called figurative Counter-point (as already observed) of which there are two Kinds: That wherein the Discords are introduced occasionally, to serve only as Transitions from Concord to Concord; and that wherein the Discord bears a chief Part of the Harmony.

Upon the unaccounted Part of the Measure, Discords may transiently pass without any great Offence to the Ear; this is called Supposition, by Reason the transient Discord supposes a Concord immediately following it.

The Harmony of Discords, is that wherein the Discords are made Use of as the solid and substantial Part of the Harmony. For by a proper Interposition of a Discord, the succeeding Concords receive an additional Lute. Thus the Discords are in *Musick*, what strong Shades are in Painting.

The Discords are the fifth when joined with the sixth, the fourth with the fifth; the ninth of its own Nature is a Discord, so is the seventh.

The Discords are introduced into Harmony with due Preparation, and must be succeeded by Concords; which is the Resolution of Discords. The Discord is prepared by substituting it first in the Harmony in Quality of a Concord, *i. e.* the same Note which becomes a Discord, is first a Concord to the bass Note, immediately preceding that to which it is a Discord.

The Discord is resolved by being immediately succeeded by a Concord, descending from it only by the Distance of a greater or lesser Second.

A Master of *Musick*, who wants to give unquestionable Proofs of his great Skill in that divine Science (which contributes to the Happiness of the Blessed in the celestial Mansions) must not only follow exactly, in his Composition, all the Rules heretofore described, but appropriate, likewise, every one of them to the Text, so that they may express as naturally as possible, the different Passions contain'd therein; for a Musician is an Afs, who though perfectly acquainted with the Rules of his Art, makes Use of them, for Example, to express in a melancholick Tune, Sentiments of Joy and Mirth, and *vice versa*; since *Musick* has been invented with no other View, than to quicken the Passions, which the Terms of the Text keep half buried; and thereby render them capable of making a greater Impression on the Soul, by affecting the Senses in a most exquisite Manner; for I consider a Piece of *Musick*, without this indispensably necessary Character, though composed according to the best Rules of the Art, as a Piece of Imagery without Life. I have often been ravished at the Pieces of *Musick* of *L'Alouette*, Master of *Musick* of *Our Lady* at *Paris*, especially at his Psalm, *Miserere mei Deus*, &c. for in that inimitable Piece, there is not a Note which is not expressive of the Word it is applied to. There are also several of the Anthems sung in the Cathedral Churches of *England*, in that excellent Taste; but for the *Musick* of *Clodkins* and *Sternhold's* Psalms, it is to the full as bad as the Poetry.

Most Pieces of *Musick* are composed in Part (*i. e.* those that deserve that Name by Way of Excellence) the four principal thereof are the *Treble*, *Tenor*, *Counter-tenor*, and *Bass*.

TREBLE is the highest, or acutest Part of the four Parts in Symphony; or that which is heard clearest in a Concert. In this Sense we say, a *Treble* Violin, *Treble* Hautboy, &c.

In *Vocal Musick*, the *Treble* is usually committed to Boys and Girls, *i. e.* their Parts are *Trebles*.

The *Treble* is divided into first or highest *Treble*, and second or low *Treble*; half *Treble* is the same with the Counter-Tenor.

The *TENOR* is the first Mean or middle Part, or that which is the ordinary Pitch of the Voice, when neither raised to a *Treble*, or lowered to a *Bass*.

The *Tenor* is commonly marked in thorough *Bass* with the Letter T. This is a Part which almost all grown Persons can sing; but as some have a greater Compass of Voice than others, either upwards or downwards others are confined to a Kind of Medium, and others can go equally high or low; hence Musicians make a Variety of *Tenors*, as a low, a high, a mean, a natural *Tenor*; to which may be added, a Violin *Tenor*, &c. for Instruments.

The *Italians* usually distinguish two Kinds of *Tenor*; *Tenore primo*, 1^o, or *po*, which is our upper *Tenor*; and *Tenore secundo*, 2^o, 11^o; confounding all the rest under the Word *Baritono*; called by the *French*, *Basse Taille*, or *Concordant*, *i. e.* that goes high and low; those that can sing thus may serve either as *Tenor* or *Bass* upon Occasion.

Tenore concertante, is the *Tenor* of the little Chorus, in which are all the Recitatives of the grand Chorus; if these are divided among many Voices or Instruments, to distinguish, they say *Tenore primo* or *secundo*, &c. as, — *Tenore primo, secundo, &c. concertante*; the *Italians* make use of this Phrase, when the Parts are different in the grand Chorus, which often happens in a Composition of several Parts. — *Tenore Rapieno*, is the *Tenor* of the grand Chorus. — *Tenore primo, secundo Choro*. —

The *Tenor* of the first and second Chorus; thus the *Italians* say of a *Tenor*, when they make a Part of each Chorus in Compositions of three or more Parts. — We often use the Word *Tenor* for the Person who sings that Part in a Concert, and for an Instrument proper to play it. COUNTER-TENOR, in the *French* called *haute contre*, is one of the mean or middle Parts, so called, as if it were opposite to the *Tenor*.

The *BASS* is that Part of a Concert which is most heard, which consists of the gravest and deepest Sounds, and which is played on the largest Pipes or Strings of a common Instrument, as of an Organ, Lute, or on Instruments larger than ordinary for that Purpose, as *Bass-Viols*, *Bassoons*, *Bass-Flautboys*, &c.

Musicians hold the *Bass* to be the principal Part of the Concert, and the Foundation of Composition; though some will have the *Treble* the chief Part, which others only make an Ornament.

A *Second*, or *Double Bass*, is called *Counter-Bass*, where there are several in the same Concert.

The *Thorough-Bass* is the Harmony made by the *Bass-Viols*, or *Theorbo*s, continuing to play both while the Voices sing, and the other Instruments perform their Parts, and also filling up the Intervals, when any of the other Parts stop.

M. *Brossard* observes the *Thorough-Bass* to be Part of the modern *Musick*, first invented in the Year 1600, by an *Italian* called *Ludovicus Viadana*, it is played by Cyphers marked over the Notes on the Organ, Spinnet, Harpsichord, Theorbo, Harp, &c. and frequently, and simply, and without Cyphers on the *Bass-Viol*, *Bassoon*, &c.

Besides these four principal Parts, there is, in a Concert, what we call *Chorus*, which is, when at certain Periods of a Song, the whole Company are to join the Singer, in repeating certain Couplets or Verses.

The Word *Choro*, or *Chorus*, is often met with, instead of *Tutti*, or *da Cappella*, which mean the grand *Chorus*, a *doi*, a *tre*, a *quatre Chori*, is for two, three, or four *Choruses*. — When after the Word *Chorus* we find *primo*, or 1^o, we must understand that it is to be played in the first *Chorus*; if 2d, 11^{do}, or *secundo*, in the second; and consequently, that the Composition is for eight Voices, or different Parts.

Those Parts are either appropriated to Voices alone, or to Instruments alone, or to both together, for there are Compositions in Parts for Voices alone called *Vocal Musick*; or for Instruments alone called *Symphony*; and both for Voices and Instruments, most commonly called *Concerts*. Though there is very seldom any *vocal Musick*, without an Accompaniment of Instruments, of a *Bass-Violin*, and a *Bassoon*, at least; often with the Organ, especially in Church-Musick.

The *VOCAL MUSICK* is *Musick* set to Words, especially Verses, to be performed with the Voice, in Contradistinction to instrumental *Musick*, composed for, and to be executed by Instruments without singing.

Poetry then makes a necessary Part of *Vocal Musick*, and this appears to have been the chief, if not the only Practice of the Antients, from the Definitions they give us of *Musick*.

Their *Vocal Musick* appears to have had some Advantage over ours, in that the *Greek* and *Latin* Languages were better contrived to please the Ear than the modern ones. In Effect, *Vossius* taxes all the latter Languages as unfit for *Musick*, and says, "We shall never have very

‘ good vocal Musick, till our Poets make Verses on the Model of the Antients, *i. e.* till the antient metrical Feet, and Quantities be restored.’

But it is to be observed, that the *Rhythmus* of their vocal Musick, was only that of their Poetry, and had no other Forms or Mutations, than those the metrical Art afforded. Their Changes of *Rhythmus*, were no other than from one Kind of Metrum to another, as from *Iambick* to *Choraick*, &c.

In the modern *Musick*, the Constitution of the *Rhythmus* differs from that Part of the Verse so far, that in setting *Musick* to Words, the Thing chiefly regarded is to accommodate the long and short Notes to the Syllables in such a Manner, as that the Words be well separated, and the accented Syllables of each Word so conspicuous, that what is sung may be distinctly understood; and one of the greatest Perfections in a Musician who executes a Piece of vocal Musick, is to articulate so well all the Words of the Text, according to the Quantity of the Syllables, that he may be clearly understood; for let him be ever so well versed in his Art, and have ever so fine a Voice, his not being understood while he sings, diminishes much his Merit as a Musician; though this Imperfection is very common in the greatest Part of Musicians, who seldom care to let us know whether they sing *Hebrew*, *Greek*, *Latin*, *English*, &c. provided they be conscious to themselves that they sing something well, and according to the Rules of *Musick*.

In the *vocal Musick*, there are Pieces composed for one, two, three, or more *Voices*; but before I proceed further on this Article, we must inform ourselves what *Voice* is.

Note, That *VOICE*, in French *voix*, in Italian *voce*, is generally speaking, a Noise or Sound formed by the Modification of the Air, *i. e.* compelled, stricken, or pressed, &c. by the Organs of the Throat of Animals. Among the different Sounds which that Modification of the Air produces, there are some which admit of no Variation of Tone, as the hissing of Serpents; others that admit of a Difference of Tune, but are not articulated, as the Noises, Whistling of Birds; and lastly, there are others subject to the Variations of Tunes, and are at the same Time articulated, *i. e.* so distinct and different from one other, that it is very easy for the Ear to perceive their Changes, such as the Voices of Men and Women.

These *Voices* alone are the Object of *Musick*, and from these, 1. *Musick* executed fully by *Voices*, is called *vocal Musick*, as being performed by natural Organs.

From thence, 2. The Degrees of Sounds which form the Extent of the Octave, are called *Voice*, and are distinguished from one another, by the seven Monosyllables, *ut, re, mi, fa, sol, la, si*.

From thence, 3. *Voices* are generally divided into three Classes: Of the first are the high or shrill *Voices*, or those performed by Women, or Children; of the second are mediate *Voices*, or Voices of a middle Pitch of Tune, neither high nor low; of the last and deep, *Voices* which consist of low and grave Sounds, both which are performed by Men, different Persons having different Compasses; these three answer to the Parts of *Musick*, called *Treble*, *Tenor*, and *Bass*; and of these are made as many Parts as the Composer pleases.

As the Harmony of Concerts is no more than a well proportioned Mixture of these *Voices*, either *simple*, *doubled*, or *tripled*, &c. the different Parts whereof the Concert is composed, are very often called *Voices*; thus they say in *Italian*, a Piece or Composition is *a due*, *a tre* *Voices*, &c. or simply *a due*, *a tre*, &c. the Word *Voice* being understood, to shew that the Piece consists of so many different Parts.

There are some indeed that call the Parts destined for Instruments so many *Voices*, by reason Instruments were invented for no other Use than either artificially, to imitate it, supply its Place, or accompany it; but this is to apply the Term improperly. The *Germans* are very particular in their Distinction of vocal and instrumental Parts, they have a Word *Stimme*, which is a general Term, and signifies *Part*, be it either for Voice or Instrument, but they always add the Adjective, vocal

or instrumental, thereto, to make a proper Distinction.

It must be here observed, that these three *Voices* usually do not exceed four Octaves from their gravest to their acuteest Sound, which form the four Octaves of the Organ, and is the ordinary Limit of other Instruments; so that all Compositions, of what Number of Parts soever, do not go beyond this Extent. It is often necessary, that the Parts (especially the vocal) have not this whole Compass, because when they raise to their highest, or fall to the lowest Sounds, they may be so forced, as that they are rendered false and disagreeable; so that to retrench the Compass, they take off some of the upper Sounds, and if the *Voice* raises to *A mi, la*, it is as high as it can well go, without a great Uneasiness to the Performer; and others are taken off from the lower Octave, for there are few *Voices* can go further than *F ut fa*, or *E si mi*, clear enough to be distinctly heard. As to the middle Parts, 'tis left to the Composer's Fancy to manage them as he thinks fit; but the general Rule is, that the Parts for either of these *Voices* be so disposed, as that the Notes may not rise or fall far above or below the Staff of five Lines, which are destined for each Cleff. But this only regards the vocal Parts, for in instrumental Musick they exceed even the four Octaves, and are obliged to those five Lines to add three or four others, as well above as below, and thereby the Compass of the Piece may rise to near five Octaves, and this is at present practised without any scruple.

Note, That *Aristoxenes* makes a Difference in the Motions of the *Voice*, and says it has two Species of Motion, continual, and divided into Intervals. The *continual*, is, when it keeps the same Degree of Tune, and appears to the Ear as neither rising nor falling (as in reading the Mono-tone,) *Vocis—duæ quedam sunt motus species continua scilicet, & intervallis disjuncta*; forcing no determinate Differences of Gravity and Acuteness, but continuing the same from Beginning to End. The Species of Motion divided into Intervals, is quite the contrary, and has many Changes in Point of Tune, at one Time high or shrill, at another grave or deep, be it in what Proportion soever, passing from one Degree of Gravity or Acuteness to another, still changing as it proceeds. When the *Voice* moves in such a Manner as not to seem to satisfy the Ear, 'tis called continual, *Cum vox ita movetur, ut nullibi consistere auditui videatur, continuum dicimus hunc motum*, when on the other Hand it proceeds by Intervals, its Motion is said to be gradual, be the intermediate Degrees large or small, it still moves from one Degree to another, and fixes some particular Tune in the Mind; whereas the continual Sound, when once finished leaves no Impression. And this gradual Motion may again be distinguished into two Kinds, which *Aristoxenes* and others call *intensio* and *remissio*; *intensio vocis* is the rising it by Degrees, in whatever Ratio's, from a grave to a more acute Sound, as *remissio* is the contrary.

A Song or Composition, to be performed with two *Voices*, or in two Parts only, one sung, the other played on an Instrument, is called a *Duo*; and likewise when two *Voices* sing different Parts, accompanied with a Third which is a thorough Bass. Unisons and Octaves are rarely used in *Duo's* except at the Beginning and the End.

A Piece of Musick to be performed by three *Voices*, or more properly a Composition consisting of three Parts only, is called *Trio*, which is the finest Kind of Composition, and ought to be the most regular of all.

For it is to be observed, 1. That besides the general Rules of Counterpoints, which forbid that two Octaves or two Fifths follow one another, either to the Bass, or among the other Parts, in *Trios* the third must be heard in every Time of the Measure, either with the Bass, or between the other two superior Parts, *i. e.* that one of the Parts make a Third with the Bass, and the other a Fifth or Octave.

2. That sometimes the Sixth, accompanied with the Octave or Fourth, may be used instead of the Third, because then the upper Parts make a Third among themselves.

3. There

3. Therefore that the Fifth and Octave are very seldom to be used, because there will then be no Third to the Bass, or between the Parts.

4. That all Discords may be used in *Trios*, the Ninth must be accompanied with the Third and Fifth, as also very well with the Seventh and redundant Fifth, provided an Octave follows.

5. That the Second must be accompanied by the fourth, and followed by the third. The fourth by the fifth or sixth, if it be syncoped, and followed by the third; if not, by the second, and followed by the fifth, just or false, as the Course of the Song or Harmony requires.

6. That the *Tritone* must be accompanied by the sixth or second, and followed by the sixth, but seldom by the Octave; the false Fifth must be accompanied by the Third, or by a Sixth, and followed by a Third.

7. That the seventh Major or Minor, if syncoped, must be accompanied by the third, fifth, or ninth; seldom or ever by the Octave.

8. That the superfluous Fifth must be accompanied by the third, &c.

9. That the seventh Major may be accompanied by the Second or Sixth, and sometimes by a Fourth, if the Bass holds on a Note.

Next to vocal Musick is that called *instrumental*, and which is made on Purpose to be played on Instruments; which are Machines invented and disposed by Art in such a Manner, as to imitate the human Voice, or supply its Place.

There are many Kinds of Instruments, which are ordinarily reduced into three Classes or Orders.

The first Class was called by the Greeks *enchorda* or *entata*; which are Instruments with Chords, and to be play'd on with the Fingers, as the *Lute*, *Harp*, *Theorbo*, *Guitar*, and others; or by a Bow, as *Violins*, *Bass Viol*, *Trumpets Marine*, &c. or by means of Jacks armed with Quills-Ends, as *Spinets*, *Harpfichords*, &c.

The second Kind, *emphysoomena*, *pneumatica*, or *emphousta*, made to sound by the Wind, and that either natural from the Mouth, as *Flutes*, *Trumpets*, *French-horns*, *Hautboys*, *Bassoons*, *Serpents*, *Sackbuts*, *Horns*, &c. or artificial by means of Bellows, as the *Bagpipe*, and that which by way of Excellence was called the *Organ*, by the *Italians* called *stromenai da fitto*.

The last the Greeks called *Knousta*, the Latins *pulsatilia*, and we *Instruments of Percussion*, because made to sound by beating them either with the Hand, as *Drums*, *Tabours*, *Tymbals*, &c. or with a little Stick, or small Iron Rod, as *Psaltery* and *Symbal*; or by a Feather, as the *Cystrum*, and *Dulcimer*; or by striking them with Hammers, as *Bells*, &c.

From this general Description of Instruments, I'll enter into a more particular one, and examine apart every one of the *Instruments* contained in each Class; beginning by the first Class, and in that Class by the *Lute*.

The *LUTE*, from the Arabick *allaud*, is a musical Instrument of the String-kind, which had antiently but five Rows of Strings; though in Course of Time, four, five, or six more have been added. It consists of four principal Parts; the Table, the Body or Belly, which has nine or ten Sides; the Neck which has nine or ten Stops or Divisions marked with Strings; and the Head or Cross, wherein are Screws, for raising or lowering the Strings to the proper Tune. In the Middle of the Table is a Rose or Passage for the Sound: There is also a Bridge that the Strings are fastened to, and a Piece of Ivory between the Head and the Neck, to which the other Extremities of the Strings are fitted. In playing the Strings are struck with the right Hand, and with the Left the Stops are pressed.

We call *Temperament of the Lute*, the Alteration requisite to be made in the Intervals, both with regard to Concorde and Discords, in order to render them more just on that Instrument.

The *Lutes of Bologna* are esteemed the best, on account of the Wood, which is said to have an uncommon Disposition for producing a sweet Sound. Formerly the *Lute* was more in Vogue than it is at present, and few Persons care to learn to play on it.

The *THEORBO*, from the French *Teorbe* or *Theorbe*,

is a musical Instrument made in Form of a large Lute, except that it has two Necks or Juga, the second and longer whereof sustains the four last Rows of Chords, which are to give the deepest Sound.

The *Theorbo* is an Instrument, which for these last sixty or seventy Years, has succeeded to the Lute, in the playing of thorough Basses: It was invented in France by *Hotteman*, and thence introduced into Italy, &c.

The only Difference between the *Theorbo* and the Lute is, that the former has eight bass or thick Strings, twice as long as those of the Lute; which Excess of Length renders their Sound so exceeding soft, and keeps it up so long a Time, that it is no Wonder many prefer it to the Harpsichord itself: At least it has this Advantage, that it is easily removed from Place to Place, &c.

All its Strings are usually single, though there are some who double the Bass-strings, with a little Octave, or the small Strings with an Unison; in which Case bearing more Resemblance to the Lute than the common *Theorbo*, the *Italians* call it the *Arcileuto* or *Arch-lute*. The *Theorbo* is also much out of Use; the Bassoon supplying well its Place, and with much more Agreement; for my Part I had never any Taste for that Instrument, or could discover any great Beauty in it, tho' I have often heard the greatest Master in France play on it, which is done by the Fingers. This Instrument seems to me to have been contrived for Ladies, because they can play on it, to accompany their Voice while they sing, without much Fatigue, which is the Reason that some Ladies in France prefer it to the Bass-Viol, and learn to play upon it.

The *GUITARRA*, has five double Rows of Strings, of which those that are Bass are in the Middle, unless it be one for the Burthen, an Octave lower than the Fourth.

This Instrument was first used in Spain, and by *Italians* it has the particular Denomination of *Spagnuolo* given it. Formerly the *Spaniards* used to serenade their *Dulcineas* with it, but at present the *Guitarra* is almost as much out of Use there as in all the other Parts of Europe.

The *HARP*, is a musical Instrument, of a triangular Figure, and placed an End between the Legs, to be played on.

There is some Diversity in the Structure of Harps, that called the *Triple Harp* has seventy-eight Strings or Chords which make four Octaves; the first Row is for Semitones, and the third is Unison with the first. There are two Rows of Pins or Screws on the right Side, serving to keep the Strings tight in their Holes, which are fastened at the other End to three Rows of Pins on the upper Side.

This Instrument is struck with the Fingers and Thumbs of both Hands, its Musick is like that of the Spinnet; all its Strings go from Semitone to Semitone; whence some called it the inverted Spinnet. It is capable of a greater Degree of Perfection than the Lute.

King David is usually painted with a Harp in his Hands; but we have no Testimony in all Antiquity that the Hebrew Harp, which they called *Chinnor*, was any thing like ours. On a Hebrew Medal of *Simon Macca-baeus* we see two Sorts of musical Instruments, they are both of them very different from our Harp, having only three or four Strings.

Papias and *Du Cange* after him, will have the Harp to have its Name from the *Arpi*, a People in Italy, who were the first that invented it, and from whom it was borrowed by other Nations.

All Authors agree that it was very different from the *Lyra*, *Cythara*, or *Barbiton*, used among the Romans.

Fortunatus, lib. 7. *carm.* 8. witnesses that it was an Instrument of the Barbarians.

Romanisque Lyra, plaudet tibi Barbarus harpa,
Græcus Achilliaca, crotta Britannia canat.

Menage, &c. derives the Word from the Latin *harpa*, and that from the German *berp* or *berpff*. Others bring it from the Latin *carpo*, because touch'd or thrum'd with the Finger. Dr. *Hicks* derives it from *harpo* or *bearpa*, which signify the same Thing; the first in the Language of the *Symbri*, the second in that of the *Anglo-Saxons*.

The second Sort of Instruments of this first Class, are those made to sound with a Bow, as the *Violin*, *Viol*, *Trumpet Marine*, &c.

The *VIOLIN*, *VIOLINO*, *Fiddle*, is a musical Instrument, mounted with four Strings or Guts; and struck or played with a Bow. The *Violin* consists, like most other Instruments, of three Parts, the *Neck*, the *Table*, and the *Sound Board*.

At the Sides are two Apertures, and sometimes a Third towards the Top, shaped like a Heart.

Its Bridge, which is below the Apertures, bears up the Strings, which are fastened to the two Extremes of the Instrument; at one of them by a Screw, which stretches or loosens them at Pleasure.

The Style and Sound of the *Violin*, is the gayest and most sprightly of all other Instruments; and hence it is of all others, the fittest for Dancing; yet there are Ways of touching it, which render it grave, soft, languishing, and fit for Church or Chamber *Musick*.

It generally makes the *Treble*, or highest Parts in Concerts. Its Harmony is from fifth to fifth. Its Play is composed of Bass, Counter-Tenor, Tenor, and Treble; to which may be added, a fifth Part: Each Part has four Fifths, which rise to a greater Seventeenth.

In Compositions of *Musick*, Violin is expressed by V, V V denote two *Violins*.

The Word *Violin* alone, stands for *treble Violin*; when the *Italians* prefix *alto*, *tenore*, or *basso*, it then expresses the Counter-Tenor, Tenor, or Bass-Violin.

In Compositions where there are two, three, or more different *Violins*, they make use of *primo*, *secundo*, *terzo*, or of the Characters I. II. III. or 1. 2. 3, &c. to denote the Difference.

The *Violin* has only four Strings, each of a different Thickness, the smallest whereof makes the E *la mi* of the highest Octave of the Organ; the second a fifth below the first, makes the A *mi la*; the third a fifth below the second, is D *la re*; lastly, the fourth a fifth below the third, is G *re sol*.

The *largest* or *fourth String*, has four Notes belonging to it, *viz.* G *re sol*, or G, which is to be played open; A *la mi re*, or A must be stopped with the Fore-Finger of the left Hand, almost at the Distance of an Inch from the Nut; B *fa be mi*, or B, with the second Finger about half an Inch from the first, and C *sol fa ut*, with the third Finger close to the Second.

The *third* has also four Notes, D *la sol re* is struck open; E *la mi* must be stopped with the Fore-Finger about an Inch from the Nut; F *ut fa*, with the second Finger close to the first; and G *re sol ut* (on which Note the Cleff is commonly marked) with the third Finger about three Quarters of an Inch from the second.

The *second String* has four Notes, A *la mi re*, or A is the open String; B *fa be mi*, or B, is with the Fore-Finger, about an Inch from the Nut; C *sol fa ut*, is the second Finger close to the first; and D *la sol re*, or D, is the third Finger about three Quarters of an Inch from the second.

The *least* or *treble String*, has usually six Notes, E *la mi*, open; F *fa ut*, or F, the Fore-Finger very near the Nut; G *sol re ut*, or G, the second about three Quarters of an Inch from the first; A *la mi re*, or A, with the third Finger at the same Distance from the second; B *fa be mi*, with the little Finger half an Inch from the third; and lastly C *fa ut*, you must stretch the little Finger about a Quarter of an Inch further, than for B *fa be mi*. But here it must be observed, that all the Notes on the Treble String, except E *la* or F, are term'd *in alt* for Distinction's Sake.

Most Nations ordinarily use the Cleff G *re sol* on the second Line, to note the *Musick* for the *Violin*, only in *France* we use the same Cleff at the first Line at Bottom: The first Method is best, where the Song goes very low, and the second where it goes very high.

The *VIOLONCELLO* of the *Italians*, is properly our fifth *Violin*, which is a little Bass *Violin*, half the Size of the common Bass *Violin*, and the Strings bigger and longer, in Proportion; and consequently its Sound an Octave lower than that of our Bass *Violin*, which has a noble Effect in great Concerto's.

The *Viola*, *Viola*, is a musical Instrument of the same Form with the *Violin*; and struck like that with a Bow.

There are *Viols* of divers Kinds. The first and principal among us, is the Bass *Viol*, called by the *Italians*, *Viola de gamba*, or the *Leg-Viol*, because held between the Legs. It is the largest of all, and is mounted with six Strings. Its Neck is divided in half Notes, by seven Frets fixed thereon. Its Sound is very deep, soft and agreeable. The *Tablature* or *Musick* for the Bass *Viol* is laid down on six Lines or Rules.

What the *Italians* call *Alto Viola*, is the Counter-Tenor of this, and their *Tenore Viola* the Tenor. They sometimes call it simply the *Viol*: Some Authors will have it the *Lyra*, others the *Cithara*, others the *Cheys*, and others the *Testudo* of the Antients.

2. The *Love-Viol*, *Viola d'amore*, which is a Kind of *Triple Viol*, or *Violin*; having six Brafs or Steel Strings, like those of the Harpsichord. It yields a Kind of Silver Sound, which has something in it very agreeable.

3. A *large Viol*, with 44 Strings, called by the *Italians*, *Viola di bardone*; but little known among us.

4. *Viola Bastarda*, or *Bastard Viol*, of the *Italians*; not used among us. *Brossard* takes it to be a Kind of Bass *Viol*, mounted with six or seven Strings, and tuned as the common one.

5. What the *Italians* call *Viola de Braccio*, *Arm-Viol*, or simply *Braccio*, *Arm*; is an Instrument answering to our Counter-Tenor, Treble, and fifth Violin.

6. Their *Viola prima*, or *first Viol*, is really our Counter-Tenor Violin; at least they commonly use the Cleff of C *sol ut* on the first Line, to denote the Piece intended for this Instrument.

7. *Viola Secunda*, is much the same with our Tenor Violin; having the Cleff of C *sol ut*, on the second Line.

8. *Viola Terza* is nearly our fifth Violin; the Cleff C *sol ut*, on the third Line.

9. *Viola Quarta*, or *fourth Viol*, is not known in *France*, or *England*: Though we frequently find it mentioned in the *Italians* Compositions; the Cleff on the fourth Line.

Lastly, their *Violetta*, or little *Viol*, is in Reality our *triple Viol*; though Strangers frequently confound the Term, with what we have said of the *Viola prima*, *secunda*, *terza*, &c.

The *TRUMPET Marine*, is a musical Instrument, consisting of three Tables, which form its triangular Body. It has a very long Neck with one single String, very thick, mounted on a Bridge, which is firm on one Side, but tremulous on the other. It is struck by a Bow with one Hand, and with the other the String is pressed or stopped on the Neck by the Thumb.

It is the Trembling of the Bridge, when struck, that makes it imitate the Sound of a Trumpet; which it does to that Perfection, that it is scarce possible to distinguish the one from the other. And this is what has given it the Denomination of *Trumpet Marine*, tho' in Propriety it be a Kind of Monochord.

The *Trumpet Marine* has the same Defects with the *Trumpet*, *viz.* that it performs none but Trumpet Notes, and some of those either too flat, or too sharp. The Reason Mr. *Roberts* accounts for, only premising that common Observation of two unison Strings, that if one be struck the other will move; the Impulses made on the Air by one String, setting another in Motion, which lies in a Disposition to have its Vibrations synchronous to them: To which it may be added, that a String will move, not only at the striking of an Unison, but also at that of an eighth or twelfth, there being no Contrariety in the Motions to hinder each other.

Now in the *Trumpet Marine*, you do not stop close, as in other Instruments, but touch the String gently with your Thumb, whereby there is a mutual Concurrence of the upper and lower Part of the String to produce the Sound. — Hence it is concluded, that the *Trumpet Marine* yields no musical Sound, but when the Stop makes the upper Part of the String an aliquot Part of the Remainder, and consequently of the whole; otherwise the Vibrations of the Parts will stop one another, and make a Sound suitable to their Motion, altogether confused. Now these aliquot Parts, he shews, are the very Stop which produce the *Trumpet* Notes.

The *Trumpet Marine*, is very much disregarded at present, if not quite out of Use; and the Sound thereof

in my Opinion, quite as disagreeable as its Shape.

The third Kind of *Instruments* of the first Class, are those made to sound by Means of Jacks, armed with Quills Ends, as *Harpsichords*, *Spinets*, &c.

The *HARPSICHORD* is a musical Instrument of the String Kind, played on after the Manner of the Organ. The *Italians* call it *Clave Cymbala*, the *French*, *Claueffin*, and the *Latins*, *Grave Cymbalum*, q. d. a large deep Cymbal.

The *Harpsichord* is furnished with a Set, and sometimes two Sets of Keys. The touching or striking these Keys, move a Kind of little Jacks, which move a double Row of Chords, or Strings of Brasses or Iron stretched on the Table of the Instrument over four Bridges.

As this Instrument is the most harmonious of all the String Kind, we shall enter into a more particular Detail thereof, as well with Regard to its Composition, as to the Uses it is contrived for.

The first Thing to be done to learn to play on this, as well as any other Instrument, is to learn the Gamut or Scale of *Musick*, by Rote; with the Names of the Notes, and their Places among the five Lines. In order to which, know that all the Lessons designed for this Instrument, are pricked on two Staves, each containing five Lines, the upper one of which Staves contains the Treble, and has the upper Cleff set at the Beginning of it: And the lower Line or Stave, has the Bass Cleff marked also at the Beginning.

To understand well all the Notes of the *Harpsichord*, and what Keys to touch in order to sound them, it must be observed, that the four Notes above the treble Stave, are called *in alt*; and those below the Bass Stave are called *double*; these Notes are helped by additional Lines, which are also called *Ledger-Lines*.

Note, That *Ledger-Line* is that which when the ascending and descending Notes run very high, or very low, is added to the Staff of five Lines; there are sometimes many of these Lines both above and below the Staff, to the Number of four or five.

Besides the two Cleffs abovementioned, there is also another, called the *Tenor-Cleff*, which is used when the Bass goes high, to avoid *Ledger-Lines*: This Cleff is generally placed on any of the four lower Lines, and sometimes on the fifth, and is always the Middle C *fa ut*, of the Instrument.

It must also be observed, that in the Gamut there are 29 white Keys (which is the Number contained in many *Harpsichords*, except those made here of late Years; to which they add, both above and below, sometimes to the Number of 37) there are also 20 black Keys, somewhat shorter than the white ones, which are placed between them, and serve for Flats and Sharps, ♭ ♯ and ✕.

If any Note therefore has a Sharp before it, the inward or short Key above it, must be touched; and if there be a Flat before it, the inward Key below it; and so on with all the inward Keys, which are Flats to the plain Keys above them, and Sharps to those below them. Between B and C, and between E and F, there are no inward Keys as there are between the others, by Reason they have an Interval but of a Semi-Tone between them.

As to the Notes and Characters in *Musick*, there are first the Notes called the *Semi-breve*, *Minim*, *Crotchet*, *Quaver*, *Semi-Quaver*, and *Demi-Semi-Quaver*. Next are the Characters which are of sharp, flat, and natural.

Next are the Rests or Pauses, being those used to denote Silence, and are of different Lengths; as the *Semi-breve-Rest*, *Minim-Rest*, *Crotchet-Rest*, *Quaver-Rest*, *Semi-Quaver-Rest*, and *Demi-Semi-Quaver*.

There are yet other Characters used in *Musick*, such as direct, which are usually set at the End of a Stave, to direct to the Place of the next Stave; as W W W.

There are also two Sorts of Bars, viz. single and double; the first serves to divide the Time according to its Measure, whether common, or Triple; the double Bars are set to divide the Strains of Songs or Tunes; thus



A Repeat which is thus : S : is used to signify that such a Part of a Tune must be played over again; from the Note it is placed over. It is also marked thus : || :

Common Chords are to be played on any Note, wherein no Figure is put, except when you play in a sharp Key; the 3d and 7th above the Key, then naturally require a 6th; but if you play in a flat Key, then a 6th is required to the 2d and 7th above the Key, unless otherwise marked.

All Keys are either flat or sharp, not by what Flats or Sharps are set at the Beginning of the Tune, but by the Third above the Key. A ♭ set over any Note, shews that it is to have a flat Third; and a ✕ a sharp one, if there be no Figure with it.

The *SPINET* is a musical Instrument, ranked in the second or third Place among harmonious Instruments. It consists of a Chest or Belly, made of the most porous or refinous Wood, and a Table of Fir fastened on Rods, called the Sound-Board, which bears on the Sides; on the Table are raised two little Prominences or Bridges; whereon are placed so many Pins as there are Chords to the Instrument.

This Instrument is played by two Ranges of continued Keys; the foremost Range being the Order of the Diatonick Scale, and that behind, the Order of the artificial Notes or Semi-Tones.

The Keys are so many long flat Pieces of Wood, which touched and pressed down at the End, make the other raise Jacks, which strike the Strings and cause the Sounds, by Means of the End of a Crow's Quill, wherewith 'tis armed. The thirty first Strings are of Brasses, the other more delicate ones of Steel or Iron-wire, which are stretched over the Bridges above-mentioned. Tho' many of these Instruments have either all their Strings of Brasses, or all of Steel Wire, and have sometimes two or three Jacks to each String, instead of one; upon which the Makers add a little Stop, to take away one or two of the three at Pleasure, by which Means the Sound, when struck with one Jack only, seems, in some Measure, to eccho to that struck with the whole Number.

The Figure of the *Spinnet* is a long Square, or Parallelogram; some call it the Harp couched; and the Harp an inverted *Spinnet*.

The *Spinnet* is generally tuned by the Ear, which Method of the practical Musicians is founded on a Supposition, that the Ear is a perfect Judge of the Octave and Fifth. The general Rule is to begin at a certain Note as C taken towards the Middle of the Instrument, and tuning all the Octaves up and down, and also the Fifths, reckoning seven Semi-Tones to each Fifth, by which Means the whole is tuned.

Sometimes to the common Fundamental play'd on the *Spinnet*, is added another similar one in Unison, and a third Octave to the first, to make the Harmony the fuller. They are either played separately or together, by Means of a Stop; and are called double or triple *Spinets*. Sometimes a Play of Violins is added by Means of a Bow, or a few Wheels parallel to the Keys, which press the Strings, and make the Sound last as long as the Musician pleases; and heighten and soften them more or less, as they are more or less pressed.

There have been of late Years *Spinets* made, whose backward Range of Keys are divided, each Part of which has a different Sound; as there is one Key between F and G, which serves as F Sharp and G Flat; now this Key being divided, that Part of it next the Player sounds G Flat, and the other next the Body of the Instrument F Sharp, and so of the others. Again, as we often use C ♭ quare, for B sharp, in these *Spinets* there is a Key placed between B natural and C, which serves as B Sharp, but those Instruments having some Difficulties attending them, were laid aside.

This Instrument takes its Name from the little Quills wherewith the Strings are struck, which are supposed to resemble Thorns, which in *Latin* are called *Spinæ*.

The greatest Masters of the *Harpsichord* and *Spinnet*, here in *England*, are in my Opinion, Mr. *Burgess*, who plays in the Orchestra of *Drury-Lane Theatre*; and the learned Mr. *Lampe*; and if I even say, that they have both a Hand, which can scarce be

excelled,

excelled, I don't believe that I say too much. I have heard the best Masters in *France*, but I have heard none that pleased my Ear better, not even the famous *Aprin* himself.

In the *second Class* of Instruments, are those which are made to sound by the Wind, and that either natural from the Mouth, as *Flutes, Trumpets, Hautboys, Bassoons, Serpents, Sackbuts, Horns, &c.* or artificial by means of Bellows, as the *Bagpipe*, and that which by way of Excellence is called the *Organ*.

The *FLUTE*, is an Instrument of Musick, the simplest of all those of the Wind Kind. It is played on by blowing in it with the Mouth, and the Tones or Notes are changed by stopping and opening the Holes, disposed for that Purpose along its Side.

There are two Sorts of *Flutes*, viz. the *common Flute*, called also *Flute à bec*, and the *German Flute*, or *Flute traversiere*.

The *Latins* call *Flute, fistula* or *tibia*, a *Pipe*; from the former of which some derive the Word *Flute*; tho' *Borel* will have it derived from *flutta* a *Lamprey*, thus called a *fluitando in fluviis*, in regard, the *Flute* is long like a *Lamprey*, and has Holes along it like that Fish.

The antient *Fistulae* or *Flutes*, were made of Reeds, afterwards of Wood, and at last of Metal, but how they were blown, whether as our *Flutes*, or as *Hautboys*, does not appear.

It is plain some had Holes, which at first were but few, but afterwards increased to a great Number; and some had none; some were single Pipes, and some a Combination of many, particularly *Pans Syringa*, which consisted of seven Reeds bound together Sideways; they had no Holes along them, each giving a distinct Sound, in all seven different Sounds, but at what Intervals is not known; perhaps they were the Notes of the diatonick Scale.

The *GERMAN FLUTE*, or *Flute Traversiere*, is an Instrument entirely different from the common *Flute*, it is not like that put into the Mouth to be played, but the End is stopp'd with a Tampion or Plug, and the lower Lip is applied to a Hole about two Inches and a Half, or three Inches distant from the End, and about half an Inch distant from the Hole. It is usually a Foot and a Half long, rather bigger at the upper End than at the lower, and perforated with Holes, besides that for the Mouth, the lowest of which is stopp'd, and opened by the little Finger's pressing on a Brass, or sometimes a Silver Key, like those on *Hautboys, Bassoons, &c.* Its Sound is exceeding sweet and agreeable, and it serves as a Treble in a Concert.

The Bass is double or quadruple its Length and Bigness, but that Instrument is partly disused, or converted into Bassoons.

The *TRUMPET*, from the Italian *Tromba*, or *Trombetta*, is a musical Instrument, the loudest of all portable ones of the Wind-kind, used chiefly in War among the Cavalry, to direct them in the Service. It is usually made of Brass, often of Silver, sometimes of Iron or Tin, and rarely even of Wood.

Moses, we read, made two of Silver, to be used by the Priests, *Numbers* x. and *Solomon* made two hundred like those of *Moses*, as we are informed by *Josephus*, *lib.* 8. which plainly shews the Antiquity of the Instrument.

The Antients had various Instruments of the Trumpet Kind, as *Tuba, Cornu*, and *Bittur*.

The modern *Trumpet* consists of a Mouth-piece, near an Inch across, though the Bottom thereof be only a third Part so much: The Pieces which convey the Wind are called the Branches; the Places where 'tis bent, the Potences; and the Canal between the second Bend and the Extremity, the Pavilion; the Places where the Branches take a turn, or are folded together, the Knots, which are five in Number, and cover the Joints. When the Sound of this Instrument is well managed 'tis of great Compass; indeed its Extent is not strictly determinable, since it reaches as high as the Strength of the Breath can force it. A good Breath will carry it beyond four Octaves, which is the usual Limit of the Keys of the Spinnet and Organ.

In War there are eight principal Manners of sounding the *Trumpet*; the first called the *Cavalquet*, used when

an Army approaches a City, or passes through it in a March. The second the *Boute-felle*, used when the Army is to decamp or march. The third is when they sound to Horse, and then to the Standard. The fourth is the *Charge*. The fifth the *Watch*. The sixth is called the *double Cavalquet*. The seventh the *Chamade*. And the eighth the *Retreat*, besides various Flourishes, Voluntaries, &c. used in Rejoycings.

There are also People who blow the *Trumpet* so softly, and draw so delicate a Sound from it, that it is used not only in Church Musick, but even in Chamber Musick; and it is on this Account that in the *Italian* and *German* Musick we frequently find Parts entitled *Tromba prima*, or I^a, *first Trumpet*, *Tromba II^a*, *Segonda*, III^a, *Terza*, second third *Trumpet*, &c. as being intended to be play'd with *Trumpets*.

There are two notable Defects in the *Trumpet*, observed by Mr. *Roberts* in the *Philosophical Transactions*. The first is, that it will only perform certain Notes within its Compass, commonly called *Trumpet Notes*; the second, that four of the Notes it does perform, are not in exact Tune.

The *HAUTBOY*, or *Hoboy*, is a Sort of musical Instrument of the Wind Kind, with a Reed to blow or play withal.

The *Hautboy*, is shaped much like the *Flute*, only that it spreads or widens towards the Bottom. The Treble is two Feet long, the Tenor goes a Fifth lower when blown open: It has only eight Holes; the Bass is five Feet long, and has eleven Holes. It is play'd on much after the Manner of the *Flute*, only it is sounded thro' a Reed.

This Instrument is thus held: Place the Left-Hand uppermost next your Mouth, and the Right-Hand below; and the contrary with left-handed People; and there are eight Holes on this Instrument, two of which are under Brass Keys, nevertheless seven Fingers will be sufficient to supply them; as for Example,

Let the Fore-finger of the Left-Hand cover the first Hole, the second on the second Hole, and the third on the next Hole, which is a double one. In like Manner the fore-finger of the Right-Hand must stop the next Hole, which is also a double one, then place the second of the same Hand on the next Hole, then the third Finger on the lowest Hole in View, and the little Finger will command the two Brass Keys to open one Hole, or shut the other, which is always open; the double Holes serve for Semitones.

Thus all the Holes of the Pipe being stopped, blow somewhat strong, and it will sound distinctly the Note *C fa ut*, which is the lowest Note on the *Hautboy*.

The *BASSOON*, is a musical Instrument of the Wind Kind, serving as a Bass in Concerts of Wind Musick, as of *Flutes, Hautboys, &c.* to make it portable. It is divided into two Parts; its Diameter at Bottom was formerly nine Inches, at present 'tis but four at most, and its Holes are stopped with Keys, &c. like large Flutes. The best *Bassoon* I ever heard was one *Le Breton*, Bassoon of our Lady at *Paris*, who invented a Counter-tenor to the *Bassoon*. The next to him is a Bassoon in the Guards of his *Britannick Majesty*; and next to him one *De Ricourt* a *Trenchman*, who is Bassoon at the Theatre in *Drury-Lane*, who is also one of the best *Hautboys* in *Europe*, and plays extremely well on the *German Flute*.

The *SERPENT*, is a musical Instrument, serving as a Bass to the Cornet, or small Shawm, to sustain a Chorus of Singers in a large Edifice.

It has its Name *Serpent* from its Figure; as consisting of several Folds or Wreaths, which serve to reduce its Length, which would otherwise be six or seven Feet.

It is usually covered with Leather, and consists of three Parts, a Mouth-piece, a Neck, and a Tail, it has six Holes, by means whereof it takes in the Compass of two Octaves. This Instrument is commonly used in Cathedral Churches, especially for the *Low Bourdon*, which is a simple Musick of Note against Note, on which Psalms and Canticks of the divine Office are often sung.

The *SACKBUT*, is a musical Instrument of the Wind Kind, being a Kind of a Trumpet, though distinct from the common Trumpet, both in Form and Sound.

The *Sackbut* is very fit for playing Bass, and is used

rived so as to be drawn out or shortned, according to the Gravity or Acuteness of the Tones. The *Italians* call it *Trambone*, the *Latins* *Tuba dulcilis*.

It takes asunder into four Pieces, or Branches, and has frequently a Wreath in the Middle; which is the same Tube, only twisted twice, or making two Circles in the Middle of the Instrument; by which Means it is brought down one Fourth lower than its natural Tone. It has also two Pieces or Branches on the Inside, which do not appear, except when drawn out by means of an Iron Bar, and which lengthens it to the Degree requisite to hit the Tone required.

The *Sackbut* is usually eight Feet long, without being drawn out, or without reckoning the Circles: When extended to its full Length, it is usually fifteen Feet, the Wreath is two Feet nine Inches in Circumference: It serves as Bass in all Concerts of Wind Musick.

There are *Sackbuts* of different Sizes, serving to execute different Parts, particularly a small one, called by the *Italians*, *Trambone picciolo*, and by the *Germans*, *Cleine alt-posaune*, proper for a Counter-tenor. The Part assigned to it is usually called *Trombone primo*, or I^o. there is another larger, called *Trombone maggiore*, which may serve as a Tenor; its Part is usually called *Trombone secondo*, or II^o. or 2^o. There is a third still bigger, called *Trombone grosso*; it is called *Trombone terzo*, or III^o. or 3^o. Lastly, there is another which exceeds all the rest, and which is much heard in the Musick, especially in the Bass; its Part is called *Trombone quarto*, or IV^o. or 4^o. or simply *trombone*; it has usually the Key of F *ut fa*, on the fourth Line; though frequently also on the fifth Line from the Top, by reason of the Gravity or Depth of the Sounds.

The *Horn*, is a Sort of musical Instrument of the Wind Kind chiefly used in Hunting, to animate the Hunters and the Dogs, and to call the latter together. The *Horn* may have all the Extent of the Trumpet.

The Term was antiently to *wind a Horn*, all *Horns* being in those Times compassed; but since strait *Horns* are come into Fashion, they say *blow a Horn*, or *sound a Horn*.

There are various Lessons for the *Horn*, as the *Recheat*, double *Recheat*, royal *Recheat*, a running or farewell *Recheat*, &c.

The *Hebrews* made use of *Horns* formed of Ram's Horns, to proclaim the Jubilee, whence the Name of *Jubilee*.

The *FRENCH HORN*, called in *France*, *Corne de basse*, is bent into a Circle, and goes two or three Times round, growing gradually bigger and wider towards the End, which in some *Horns* is nine or ten Inches over.

To play on it, the first Thing is to consider the Thickness or Thinness of the Lips, and provide a Mouth-piece accordingly; if they are thick, a pretty broad Mouth-piece is required, but if thin, the Piece must be something smaller. Some Musicians have brought the *French Horn* to that Perfection, and sound it so sweetly, that of late Years it has been introduced into the Orchestra, among the other Instruments.

The last Kind of Instruments of the second Class, which are those made to sound by means of Bellows, are the *Bagpipe* and the *Organ*.

The *BAGPIPE*, is a musical Instrument of the Wind Kind, chiefly used in Country Places. It consists of two Parts; the first is a Leather Bag, which is blown like a Foot-ball by means of a Provent, or little Tube fixed to it, and stopped by a Valve. The other Part consists of three Pipes or Flutes, the first is called the great Pipe or Drone, the second the little one, which passes the Wind out only at Bottom, and the third as a Tongue, and is played by compressing the Bag when full, under the Arm, and opening and stopping the Holes, which are eight, with the Fingers. The little Pipe is ordinarily a Foot long, that played on, thirteen Inches, and the Provent six. This Instrument takes in the Compass of three Octaves.

The *ORGAN*, is the largest and most harmonious of all Wind-Instruments, chiefly used for playing a thorough Bass, with all its Accompaniments.

The *Organ* is an Assemblage of several Rows of Pipes; its Size is usually expressed by the Length of its largest

Pipe: Thus we say an *Organ* of 32 Feet, of 16 Feet, of 8 Feet, and of 2 Feet.

Church-Organs consist of two Parts, viz. the main Body of the *Organ*, called the *great Organ*; and the *positive* or *little Organ*, which is a small Buffet, usually placed before the great *Organ*.

The *Organ* has at least one Set of Keys, when it has only one Body, and two or three when it has a *positive*. The large *Organs* have four, sometimes five Sets; besides, the Pedals or largest Pipes have their Keys, the Stops or Touches whereof are played by the Feet.

The Keys of an *Organ* are usually divided into four Octaves, viz. the second Sub-octave, first Sub-octave, middle Octave, and first Octave. Each Octave is divided into twelve Stops or Frets, whereof the seven black mark the natural Sounds, and the five white the artificial Sounds, i. e. the Flats and Sharps; so that the Keys usually contain 48 Stops or Touches. Some Organists add to this Number one or more Stops in the third Sub-octave, as well as in the second. The Pedals extend to two or three Octaves, at the Pleasure of the Organist, so that the Number of Stops is undeterminate.

Each Key or Stop pressed down opens a Valve or Plug, which corresponds Lengthwise to as many Holes as there are Rows of Pipes in the Sound-boards. The Holes of each Row are opened, and shut by a Register or Ruler pierced with 48 Holes: By drawing the Register, the Holes of one Row are opened, because the Holes of the Register correspond to those of the Sound-board: So that by opening a Valve, the Wind brought into the Sound-board by a large Pair of Bellows, finds a Passage into the Pipe, which corresponds to the open Holes of the Sound-board; but by pushing the Register, the 48 Holes of the Register not answering to any of those of the Sound-board, that Row of Pipes answering to the pushed Register, are shut. Whence it follows, that by drawing several Registers, several Rows of Pipes are opened; and the same Thing happens, if the same Register corresponds to several Rows. Hence the Rows of Pipes become either simple or compound; *simple*, when only one Row answers to one Register; *compound*, where several. The Organists say, a Row is compound, when several Pipes play upon the pressing one Stop.

The Pipes of the *Organ* are of two Kinds, the one with Mouths like our Flutes, and the other with Reeds: The first called Pipes of Mutation, consists,

1. Of a Foot, A A B B (*fig. 15. tab. miscell.*) which is a hollow Cone, and which receives the Wind that is to sound the Pipe.

2. To this Foot is fastened the Body of the Pipe, B B D, between the Foot and the Body of the Pipe is a Diaphragm or Partition E E F, which has a little, long, narrow Aperture to let out the Wind. Over this Aperture is the Mouth B B C C, whose upper Lip C C, being level, cuts the Wind as it comes out at the Aperture.

The Pipes are of Pewter, Lead mixed with a twelfth Part of Tin, and of Wood; those of Tin are always open at their Extremities; their Diameter is very small, their Sound is very clear and shrill. Those of Lead mixed are larger; the shortest open, the longest quite stopped, the mean ones partly stopped, and having besides a little Ear on each Side of the Mouth, to be drawn closer, or set further asunder, in order to raise or lower the Sound. The wooden Pipes are made square, and their Extremities stopped with a Valve or Tampion of Leather. The Sound of the wooden and leaden Pipes are very soft; the large ones stopped are usually of Wood, the small ones of Lead, the longest Pipes give the gravest Sound, and the shortest the most acute; their Length and Width are made in the reciprocal Ratio's of their Sounds, and the Divisions regulated by their Rule, which they call the Diapason: But the Pipes that are shut have the Length of those that are open, and which yield the same Sound; usually the longest Pipe is sixteen Feet, tho' in extraordinary *Organs* 'tis thirty-two; the pedal Tubes are always open, though made of Wood and of Lead.

A Reed-pipe consists of a Foot, A A B B, (*tab. miscell. fig. 16.*) which carries the Wind into the Shalot, or Reed C D, which is a hollow Demi-Cylinder, fitted at its

Extremity D, into a Kind of Mould II, by a wooden Tampion F G. The Shalot is covered with a Plate of Copper E E F F, fitted at its Extremity F F, into the Mould by the same wooden Tampion; its other Extremity E E is at Liberty; so that the Air entering the Shalot, makes it tremble or shake against the Reed; and the longer that Part of the Tongue which is at Liberty F L, is made, the deeper is the Sound. The Mould II which serves to fix the Shalot or Reed, the Tongue, Tampion, &c. serves also to stop the Foot of the Pipe, and to oblige the Wind to go out wholly at the Reed. Lastly, in the Mould is foldered the Part H H K K, called the Tube, whose inward Opening is a Continuation of that of the Reed. The Form of this Tube is different in the different Ranks of Pipes.

The Degree of Acuteness and Gravity in the Sound of a Reed-Pipe, depends on the Length of the Tongue, and the Tube; and also on the Thickness of the Tongue, the Figure of the Tube, and the Quantity of Wind.

To diversify the Sounds of the Pipes, they add a Valve to the Port-vent, which lets the Wind go in Fits or Shakes.

Note, That the Invention of the Organ is very antient, though it is agreed it was little used till the eighth Century. It seems to have been borrowed from the *Greeks*. *Vitruvius* describes one in his tenth Book: The Emperor *Julian* has an Epigram in its Praise; *St. Jerom* mentions one with twelve Pair of Bellows, which might be heard a thousand Paces, or a Mile; and another at *Jerusalem*, which might be heard to the Mount of *Olives*.

Note, also, The best Factor, or Organ-Builder in *England*, and one of the best in *Europe*, is Mr. *Abraham Jordan*, and the best Organist is the most celebrated Dr. *Green*, Master of Musick of the King's Chapel.

There have been antiently, and are still in *Italy* in the Grotto's of the Vineyards *hydraulick Organs*, which is a musical Machine that plays by means of Water.

Ctesibes of *Alexandria*, who lived in the Reign of *Ptolemy Evergetes*, is said to have first invented *Organs* that plaid by compressing the Air with Water, as is still practised. *Archimedes* and *Vitruvius* have left us Descriptions of the *hydraulick Organs*.

In the Cabinet of *Queen Christina* is a beautiful and large Medallion of *Valentinian*, on the reverse whereof is seen one of these *hydraulick Organs*, with two Men, one on the Right, the other on the Left, seeming to pump the Water which plays it, and to listen to its Sound. It has only eight Pipes placed on a round Pedestal. The Inscription is *Placca Spetri*, if it be not wrong copied, which we suspect.

The last Class of Instruments, we call *Instruments of Percussion*, because made to sound either with the Hand, as *Drums*, *Tabor*s, *Tymbals*, &c. or with little Sticks, or small Iron Rods, as *Psaltery* and *Cymbal*; or with a Feather, as the *Systrum* and *Dulcimer*; or by striking them with Hammers, as Bells, &c.

The *Drum*, is a military musical Instrument, of the Pulsatile Kind, used principally among the Foot, to call the Soldiers together, to direct their March, Attack, Retreat, &c.

The Body of the *Drum* is of very thin Oak, bent into a Cylinder, and covered with Parchment, which is strained or braced more or less, according to the Height or Depth of the Tone required, by Strings, and struck with Sticks.

There are divers Beats of the *Drum*, as the *March*, *double March*, *Assemblée*, *Charge*, *Retreat*, *Chamade*, &c.

The *Tymbal*, or *Tympanum*, which among the Antients consisted of a thin Piece of Leather or Skin, stretched on a Circle of Wood or Iron, and beat with the Hand.

This may be our Kettle-Drum, as it appears to be from the *Italians* using the Word *Tympano* for a Pair of *Tymbals* of an unequal Size tuned a Fourth, the least whereof gives the acute Sound, the largest the grave one; the first is *C sol ut*, the latter *G re sol*, a Fourth lower; they serve for a Bass in a Concert, or Airs designed for Trumpets; we from hence meet with Airs marked *tympane*, which shew that they are destined

for this Instrument.

The *KETTLE-DRUMS*, have their Body of Brass, and are used among the Horse to be play'd on, being hung or laid a-crofs the Shoulders of the Horse before the Drummer, who with a Variety of odd Gestures, beats them with two little Iron Bars with Balls at the End; their Sound is softer, and more agreeable than that of the common Drum; and they are often used in Opera's, Oratorio's, Tragedies, and Concerts.

PSALTERION, *Psaltery*, is a musical Instrument much in Use among the antient *Hebrews*, who called it *Nobel*. We know little or nothing of the precise Form of the antient *Psaltery*.

That now in Use is a flat Instrument in Form of a *Trapazium*, or Triangle truncated a-top.

It is strung with thirteen Wire-Chords set to Unison Octave, and mounted on two Bridges on the two Sides. It is struck with a Plectrum, or little Iron Rod, or sometimes with a crooked Stick, whence 'tis ranked among the Instruments of Percussion. Its Chest or Body resembles that of a Spinet. It has for its Name *Appalendo*, some also now call it *Nablum* or *Nablium*.

The *DULCIMER*, is a musical Instrument, with Wire Strings, in a triangular Form, strung with about fifty Strings, cast over a Bridge at each End, and the acuter gradually the shorter, the shortest about eighteen Inches, and the longest about thirty-six, struck with little Iron Rods: The Bass Strings are doubled, and its Sound is not disagreeable: To be plaid on, 'tis laid on a Table before the Performer, who with a little Iron Rod in each Hand, strikes the Strings. This Instrument is not much used except among Puppet-Shews.

I'll say nothing of *Bells* in this Place, since it would be only a Repetition of what I have said of them in my Treatise of Clock-making under the Letter C.

Most commonly the Instruments are disposed in a Place a-part, called the *Orchestra*, particularly in Tragedies, Comedies, Operas, Oratorios, Serenata's, &c.

The Musick of the Instruments is most commonly called *Symphony*, and particularly that where the Composer is not confined to a certain Number, or certain Species of Measure; such as are the *Preludes*, *Phantasias*, *Ricercatas*, *Toccatas*.

PRELUDE, in *Italian Preludio*, is a Flourish or an irregular Air, which a Musician plays off-hand, to try if his Instrument be in Tune, and so lead him into the Piece to be play'd. Overtures of Operas are a Sort of *Preludes*; very often the whole Band in the Orchestra run a few Divisions to give the Tune. This is also called *Phantasia*, *Ricercata*, &c.

The *Symphony*, or *instrumental Musick*, makes also one of the most essential Parts in a Concert, Opera, Oratorio, Cantata, &c.

A *CONCERT*, popularly called *Consort*, is a Number or Company of Musicians playing or singing the same Piece or Song at the same Time.

The Word *Concert* may be applied where the Musick is only Melody, that is, the Performers all in Unison; but it is more properly as well as more usually understood of Harmony, or where the Musick consists of divers Parts, as Treble, Tenor, and Bass, &c.

A *Concert* for any Instrument, as Organ, Harpsichord, Violin, &c. is a Piece of Musick wherein either of these Instruments has the greatest Part, or in which the Performance is partly alone, and partly accompanied by the other Parts.

Those Parts of a Piece of Musick that sing or play throughout the whole Piece, either alone or accompanied, are distinguished from those Parts that play now and then in particular Places, by the Word *concertante*, and the grand Chorus of a *Concert*, or those Places where all the several Parts perform or play together, is called *concerto gralli*: The *Treble* of the principal concerting Parts, is called *canto concertante*; this Part generally plays and sings throughout; but being the chosen Voices, or Instruments, they sometimes rest during the Chorus, and the *Treble* of the grand Chorus, or that Part that plays or sings in the grand Chorus only, *canto ripieno*.

A *CANTATA*, is a Song, or Composition, intermixed with Recitatives, little Airs, and different Motions, and merrily intended for a single Voice, with a thorough Bass, tho' sometimes for two Violins, and other Instruments.

When

When the Words or Subjects are intended for the Church, it is called *Cantata morali o spirituali*: But when on Love, *Cantata amoroſe*, &c.

If the Words are well adapted to the *Muſick*, it has ſomething in it very agreeable, and generally ſeems to pleaſe by its Varieties, conſiſting of grave Parts and Airs intermixed; firſt uſed in *Italy*, then in *France*, whence it paſſed into *England*. — The *Cantata's* of *Purcel* are excellent.

Note, That *Recitative*, in *Italian Recitativo*, is a Kind of Singing, that differs but little from the ordinary Pronunciation, ſuch as that wherein the ſeveral Parts of the Liturgy are rehearſed in Churches, or Cathedrals, or that wherein the Actors commonly deliver themſelves on the Theatre at the Opera, tho' the former is rather a Chant. The *Italians* value themſelves on their Performances of this Kind, or *Recitative Way*. Mr. *Broſſard* ſays, theſe Words are often found in *Italian Cantata's*, and are ſtill more common in their Opera's, which, to ſpeak plain, are no more than ſo many ſucceſſive *Cantata's*, that have ſome Connection to a general Subject, which runs through the whole Opera; 'tis according to him, as has been ſaid, a Manner of Singing, which borders upon declaiming, as if one declaimed in Singing, or ſung in declaiming, and in Conſequence wherein more Regard is had to the Expreſſion of the Paſſion, than of exactly obſerving a regular Movement. Notwithſtanding this Sort of Composition is noted in true Time, the Performer is at Liberty to alter the Parts of Meaſure, and make ſome long, others ſhort, as his Subject requires. Hence the thorough Baſs to the *Recitative*, is ordinarily placed below the other, to the End that he who is to accompany the Voice, may rather obſerve and follow the Singer, than the Perſon that beats the Time. The *French* call whatever the *Italians* call by the Name of *Solo* or *Soli*, be it one, two, three, four, or more Parts, by the general Title of *Recit.*

OPERA, is a dramatiſtick Composition, ſet to *Muſick*, and ſung on a Stage, accompanied with muſical Inſtruments, and enriched with magnificent Dreſſings, Machines, and other Decorations.

The *Engliſh* derive the *Opera's* from the *French*, they from the *Italians*; and the *Venetians*, who hold it as one of the principal Glories of their Carnival, firſt invented it.

ORATORIO, is a Sort of ſpiritual Opera, full of Dialogues, *Recitativo's*, Duetto's, Trio's, Rittornello's, Chorus's, &c. the Subject whereof is uſually taken from the Scripture, or is the Life and Actions of ſome Saint, &c. The *Muſick* for the *Oratorio* ſhould be in the fineſt Taſte, and moſt choſen Strains. The Words whereof are often in *Latin*, ſometimes in *French* and *Italian*, and alſo in *Engliſh*. The *Oratorio's* are greatly uſed at *Rome*, in Time of Lent.

A Piece of *Muſick* or Composition, wholly to be executed by Inſtruments, is called *SONATA*, by the *Italians* *Suonata*, from *Suono*, Sound. This is with Regard to Inſtruments of ſeveral Kinds, what *Cantata* is with Regard to the Voice.

The *Sonata*, then, is properly a grand free harmonious Composition, diverſified with great Variety of Motions and Expreſſions, extraordinary and bold Strokes, and Figures, &c. and all this to the Fancy of the Composer, who without conſining himſelf to any general Rule of Counter-Point, or any fixed Number or Meaſure, gives a Loofe to his Genius, and runs from one Mode, Meaſure, &c. to another as he thinks fit.

We have *Sonata's* from one to ſeven and eight Parts; but uſually they are performed by a ſingle Violin, or with two Violins, and a thorough Baſs for the Harpſichord, and frequently a more figured Baſs for the Baſs Violin.

There are many different Species of *Sonata's*, but the *Italians* reduce them to two Kinds, *Suonata di Chieſa*, that is, one proper for Church *Muſick*, which commonly begins with a grave ſolemn Motion, ſuitable to the Dignity of the Place, and the Service; after which they ſtrike into a more briſk, gay, rich Manner, and theſe are what they properly call *Sonata's*.

The other comprehends the *Suonata di Camera*, ſit

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for Chamber *Muſick*. Theſe are properly a Series of little ſhort Pieces, named from the Dances, which may be put to them, yet not deſigned for Dancing, though a Maſter of that Art may have a Mind to apply certain Poſitions and Steps thereto; which by his Judgment are made to agree with their Motions. They uſually begin with a Prelude or little *Sonata*, ſerving as an Introduction to all the reſt; afterwards come the *Allemand*, *Pavan*, *Courant*, and other ſerious Dances; after them *Jiggs*, *Gavots*, *Minuets*, *Chacones*, *Paſſecailles*, and more gay Airs, the whole compoſed in the ſame Tone or Mode.

Note, That as there are ſeveral *Italian* and technical Expreſſions in *Muſick*, which have not been mentioned in the Courſe of this Treatiſe, and which every Muſician ſhould know, I'll give here an alphabetical Catalogue thereof, with the Explication of every one of them in particular; therefore,

A.

A *Majuſcule* in thorough Baſſes, marks the *Alto*, or *Haut-contre*.

A *bene placito*, at Pleaſure.

ACCENTOR, one of three Singers in Parts, or the Perſon that ſings the predominant Part in a *Trio*.

ACCORD, from the *French Corde*, a String or Chord, is thus called on Account of the agreeable Union of the Sounds of two Strings, ſtruck at the ſame Time, whence alſo ſome of the Conſonances in *Muſick* come to be called *Tetrachords*, *Hexachords*, &c. which are Fourth's and Sixth's.

M. *Carree*, in the *Memoirs of the Royal Academy of Sciences*, lays down a new general Propoſition of the Proportions which two Cylinders are to have in order to form the Accords or Conſonances in *Muſick*. He ſays, that the ſolid Cylinders, whoſe Sounds yield thoſe Accords, are in a triplicate and inverted Ratio of that of the Numbers, which expreſs the ſame Accords. Suppoſe, for Example, two Cylinders, the Diameter of whoſe Baſſes and Lengths, are as 3 : 2, 'tis evident, the Solidities will be in the Ratio of 27 : 8, which is the triplicate Ratio of 3 : 2, we ſay, that the Sounds of thoſe two Cylinders will produce a Fifth, which is expreſſed by thoſe Numbers, and that the biggeſt and longeſt will yield the grave Sound, and the ſmalleſt the acute one; and the like of all others.

ACCREſſIMENTO, ſignifies Augmentation, as *Punto d'Accreſſimento*, Point of Augmentation.

ACUTE, is underſtood of a Sound or Tone, which is ſhrill or high in Reſpect of ſome other. In this Senſe the Word ſtands oppoſed to *Grave*. Sounds conſidered as acute and grave, *i. e.* in Relation of Gravity and Acuteness, conſtitute what we call Tune, the Foundation of all Harmony.

ADAGIO, is one of the Words uſed by the *Italians*, to denote a certain Degree or Diſtinction of Time. — The *Adagio* expreſſes a ſlow Time, ſloweſt of any except grave. — The Triples $\frac{3}{4}$, $\frac{3}{8}$, are ordinarily *Adagio*.

A *DUE*, or *Doi*, *Tree*, a *Quarto*, &c. ſignifies for two, for three, for four, &c.

ALLEGRETTO, a Diminutive of *Allegro*, which therefore means pretty quick, but not ſo quick as *Allegro*.

ALLEGRO, is uſed to ſignify, that the *Muſick* ought to be performed in a briſk, lively, gay, and pleaſant Manner, yet without Hurry and Precipitation, and quicker than any except *Presto*. The uſual ſix Diſtinctions ſucceed each other in the following Order, *Grave*, *Adagio*, *Largo*, *Vivace*, *Allegro*, and *Presto*.

Note, That the Movements of the ſame Name as *Adagio*, or *Allegro*, are ſwifter in Triples than in common Time; the Triples $\frac{3}{4}$ is *Adagio*, *Allegro*, or *Vivace*; the Triples $\frac{3}{8}$, $\frac{3}{16}$, are moſt commonly *Allegro*. If preceded by *Poco*, it weakens the Strength of its Signification, intimating that the *Muſick* muſt not be performed quite ſo briſk and lively as *Allegro* would require if it ſtood alone. If *Allegro* be preceded by *Piu*, it adds to the Strength of its Signification, requiring the *Muſick* to be performed more briſk and gay than *Allegro* alone intimated. *Allegro* ſignifies much the ſame as *Piu allegro*. *Allegro ma non preſto*, briſk and lively, but not too haſtily.

ALT, from the *Latin Alto*, is a Term applied to the high Notes in the Scale.

G X

ANDANTE,

Extremity D, into a Kind of Mould II, by a wooden Tampion F G. The Shalot is covered with a Plate of Copper E E F F, fitted at its Extremity F F, into the Mould by the same wooden Tampion; its other Extremity E E is at Liberty; so that the Air entering the Shalot, makes it tremble or shake against the Reed; and the longer that Part of the Tongue which is at Liberty F L, is made, the deeper is the Sound. The Mould II which serves to fix the Shalot or Reed, the Tongue, Tampion, &c. serves also to stop the Foot of the Pipe, and to oblige the Wind to go out wholly at the Reed. Lastly, in the Mould is foldered the Part H H K K, called the Tube, whose inward Opening is a Continuation of that of the Reed. The Form of this Tube is different in the different Ranks of Pipes.

The Degree of Acuteness and Gravity in the Sound of a Reed-Pipe, depends on the Length of the Tongue, and the Tube; and also on the Thickness of the Tongue, the Figure of the Tube, and the Quantity of Wind.

To diversify the Sounds of the Pipes, they add a Valve to the Port-vent, which lets the Wind go in Fits or Shakes.

Note, That the Invention of the Organ is very antient, though it is agreed it was little used till the eighth Century. It seems to have been borrowed from the *Greeks*. *Vitruvius* describes one in his tenth Book: The Emperor *Julian* has an Epigram in its Praise; *St. Jerom* mentions one with twelve Pair of Bellows, which might be heard a thousand Paces, or a Mile; and another at *Jerusalem*, which might be heard to the Mount of *Olives*.

Note, also, The best Factor, or Organ-Builder in *England*, and one of the best in *Europe*, is Mr. *Abraham Jordan*, and the best Organist is the most celebrated Dr. *Green*, Master of Musick of the King's Chapel.

There have been antiently, and are still in *Italy* in the Grotto's of the Vineyards *hydraulick Organs*, which is a musical Machine that plays by means of Water.

Ctesebes of *Alexandria*, who lived in the Reign of *Ptolemy Evergetes*, is said to have first invented *Organs* that plaid by compressing the Air with Water, as is still practised. *Archimedes* and *Vitruvius* have left us Descriptions of the *hydraulick Organs*.

In the Cabinet of Queen *Christina* is a beautiful and large Medallion of *Valentinian*, on the reverse whereof is seen one of these *hydraulick Organs*, with two Men, one on the Right, the other on the Left, seeming to pump the Water which plays it, and to listen to its Sound. It has only eight Pipes placed on a round Pedestal. The Inscription is *Placca Spetri*, if it be not wrong copied, which we suspect.

The last Class of Instruments, we call *Instruments of Percussion*, because made to sound either with the Hand, as *Drums*, *Tabors*, *Tymbals*, &c. or with little Sticks, or small Iron Rods, as *Psaltory* and *Cymbal*; or with a Feather, as the *Syltrum* and *Dulcimer*; or by striking them with Hammers, as Bells, &c.

The *Drum*, is a military musical Instrument, of the Pulsatile Kind, used principally among the Foot, to call the Soldiers together, to direct their March, Attack, Retreat, &c.

The Body of the *Drum* is of very thin Oak, bent into a Cylinder, and covered with Parchment, which is strained or braced more or less, according to the Height or Depth of the Tone required, by Strings, and struck with Sticks.

There are divers Beats of the *Drum*, as the *March*, *double March*, *Assemblée*, *Charge*, *Retreat*, *Chamade*, &c.

The *TYMBAL*, or *Tympanum*, which among the Antients consisted of a thin Piece of Leather or Skin, stretched on a Circle of Wood or Iron, and beat with the Hand.

This may be our Kettle-Drum, as it appears to be from the *Italians* using the Word *Tympano* for a Pair of *Tymbals* of an unequal Size tuned a Fourth, the least whereof gives the acute Sound, the largest the grave one; the first is *C sol ut*, the latter *G re sol*, a Fourth lower; they serve for a Bass in a Concert, or Airs designed for Trumpets; we from hence meet with Airs marked *tympano*, which shew that they are destined

for this Instrument.

The *KETTLE-DRUMS*, have their Body of Brass, or are used among the Horse to be play'd on, being laid across the Shoulders of the Horse before the Drummer, who with a Variety of odd Gestures, beats them with two little Iron Bars with Balls at the End. their Sound is softer, and more agreeable than that of the common Drum; and they are often used in Opera's, Oratorio's, Tragedies, and Concerts.

PSALTERION, *Psaltory*, is a musical Instrument much in Use among the antient *Hebrews*, who called it *Nebal*. We know little or nothing of the precise Form of the antient *Psaltory*.

That now in Use is a flat Instrument in Form of a *Trapazium*, or Triangle truncated a-top.

It is strung with thirteen Wire-Chords set to Unison Octave, and mounted on two Bridges on the two Sides. It is struck with a Plectrum, or little Iron Rod, or sometimes with a crooked Stick, whence 'tis ranked among the Instruments of Percussion. Its Chest or Body resembles that of a Spinnet. It has for its Name *Apfalemb*, some also now call it *Nablum* or *Nablium*.

The *DULCIMER*, is a musical Instrument, with Wire Strings, in a triangular Form, strung with about fifty Strings, cast over a Bridge at each End, and the acuter gradually the shorter, the shortest about eighteen Inches, and the longest about thirty-six, struck with little Iron Rods: The Bass Strings are doubled, and its Sound is not disagreeable: To be plaid on, 'tis laid on a Table before the Performer, who with a little Iron Rod in each Hand, strikes the Strings. This Instrument is not much used except among Puppet-Shews.

I'll say nothing of *Bells* in this Place, since it would be only a Repetition of what I have said of them in my Treatise of Clock-making under the Letter C.

Most commonly the Instruments are disposed in a Place a-part, called the *Orchestra*, particularly in Tragedies, Comedies, Operas, Oratorios, Serenata's, &c.

The Musick of the Instruments is most commonly called *Symphony*, and particularly that where the Composer is not confined to a certain Number, or certain Species of Measure; such as are the *Preludes*, *Phantasias*, *Ricercatas*, *Toccatas*.

PRELUDE, in *Italian Preludio*, is a Flourish or an irregular Air, which a Musician plays off-hand, to try if his Instrument be in Tune, and so lead him into the Piece to be play'd. Overtures of Operas are a Sort of *Preludes*; very often the whole Band in the Orchestra run a few Divisions to give the Tune. This is also called *Phantasia*, *Ricercata*, &c.

The *Symphony*, or *instrumental Musick*, makes also one of the most essential Parts in a Concert, Opera, Oratorio, Cantata, &c.

A *CONCERT*, popularly called *Confort*, is a Number or Company of Musicians playing or singing the same Piece or Song at the same Time.

The Word *Concert* may be applied where the Musick is only Melody, that is, the Performers all in Union; but it is more properly as well as more usually understood of Harmony, or where the Musick consists of divers Parts, as Treble, Tenor, and Bass, &c.

A *Concert* for any Instrument, as Organ, Harpsichord, Violin, &c. is a Piece of Musick wherein either of these Instruments has the greatest Part, or in which the Performance is partly alone, and partly accompanied by the other Parts.

Those Parts of a Piece of Musick that sing or play throughout the whole Piece, either alone or accompanied, are distinguished from those Parts that play now and then in particular Places, by the Word *concertante*, and the grand Chorus of a *Concert*, or those Places where all the several Parts perform or play together, is called *concerto grosso*: The Treble of the principal concerting Parts, is called *canto concertante*; this Part generally plays and sings throughout; but being the chosen Voices or Instruments, they sometimes rest during the Chorus, and the Treble of the grand Chorus, or that Part that plays or sings in the grand Chorus only, *canto ripieno*.

A *CANTATA*, is a Song, or Composition, intaimed with Recitatives, little Airs, and different Motions, and merrily intended for a single Voice, with a thorough Bass, tho' sometimes for two Violins, and other Instruments.

When the Words or Subjects are intended for the Church, it is called *Cantata morali ó spirituali*: But when on Love, *Cantata amorose*, &c.

If the Words are well adapted to the *Musick*, it has something in it very agreeable, and generally seems to please by its Varieties, consisting of grave Parts and Airs intermixed; first used in *Italy*, then in *France*, whence it passed into *England*. — The *Cantata's* of *Purcel* are excellent.

Note, That *Recitative*, in *Italian Recitativo*, is a Kind of Singing, that differs but little from the ordinary Pronunciation, such as that wherein the several Parts of the Liturgy are rehearsed in Churches, or Cathedrals, or that wherein the Actors commonly deliver themselves on the Theatre at the Opera, tho' the former is rather a Chant. The *Italians* value themselves on their Performances of this Kind, or *Recitative Way*. Mr. *Brossard* says, these Words are often found in *Italian Cantata's*, and are still more common in their Opera's, which, to speak plain, are no more than so many successive *Cantata's*, that have some Connection to a general Subject, which runs through the whole Opera; 'tis according to him, as has been said, a Manner of Singing, which borders upon declaiming, as if one declaimed in Singing, or sung in declaiming, and in Consequence wherein more Regard is had to the Expression of the Passion, than of exactly observing a regular Movement. Notwithstanding this Sort of Composition is noted in true Time, the Performer is at Liberty to alter the Parts of Measure, and make some long, others short, as his Subject requires. Hence the thorough Bass to the *Recitative*, is ordinarily placed below the other, to the End that he who is to accompany the Voice, may rather observe and follow the Singer, than the Person that beats the Time. The *French* call whatever the *Italians* call by the Name of *Solo* or *Soli*, be it one, two, three, four, or more Parts, by the general Title of *Recit.*

OPERA, is a dramatick Composition, set to *Musick*, and sung on a Stage, accompanied with musical Instruments, and enriched with magnificent Dressings, Machines, and other Decorations.

The *English* derive the *Opera's* from the *French*, they from the *Italians*; and the *Venetians*, who hold it as one of the principal Glories of their Carnival, first invented it.

ORATORIO, is a Sort of spiritual Opera, full of Dialogues, *Recitativo's*, Duetto's, Trio's, Rittornello's, Chorus's, &c. the Subject whereof is usually taken from the Scripture, or is the Life and Actions of some Saint, &c. The *Musick* for the *Oratorio* should be in the finest Taste, and most chosen Strains. The Words whereof are often in *Latin*, sometimes in *French* and *Italian*, and also in *English*. The *Oratorio's* are greatly used at *Rome*, in Time of *Lent*.

A Piece of *Musick* or Composition, wholly to be executed by Instruments, is called *SONATA*, by the *Italians* *Sonata*, from *Suono*, Sound. This is with Regard to Instruments of several Kinds, what *Cantata* is with Regard to the Voice.

The *Sonata*, then, is properly a grand free harmonious Composition, diversified with great Variety of Motions and Expressions, extraordinary and bold Strokes, and Figures, &c. and all this to the Fancy of the Composer, who without confining himself to any general Rule of Counter-Point, or any fixed Number or Measure, gives a Loose to his Genius, and runs from one Mode, Measure, &c. to another as he thinks fit.

We have *Sonata's* from one to seven and eight Parts; but usually they are performed by a single Violin, or with two Violins, and a thorough Bass for the Harpsichord, and frequently a more figured Bass for the Bass Violin.

There are many different Species of *Sonata's*, but the *Italians* reduce them to two Kinds, *Suonata di Chiesa*, that is, one proper for Church *Musick*, which commonly begins with a grave solemn Motion, suitable to the Dignity of the Place, and the Service; after which they strike into a more brisk, gay, rich Manner, and these are what they properly call *Sonata's*.

The other comprehends the *Suonata di Camera*, fit

for Chamber *Musick*. These are properly a Series of little short Pieces, named from the Dances, which may be put to them, yet not designed for Dancing, though a Master of that Art may have a Mind to apply certain Positions and Steps thereto; which by his Judgment are made to agree with their Motions. They usually begin with a Prelude or little *Sonata*, serving as an Introduction to all the rest; afterwards come the *Allemand*, *Pavan*, *Courant*, and other serious Dances; after them *Jiggs*, *Gavots*, *Minuets*, *Chacones*, *Passecailles*, and more gay Airs, the whole composed in the same Tone or Mode.

Note, That as there are several *Italian* and technical Expressions in *Musick*, which have not been mentioned in the Course of this Treatise, and which every Musician should know, I'll give here an alphabetical Catalogue thereof, with the Explication of every one of them in particular; therefore,

A.

A *Majuscule* in thorough Basses, marks the *Alto*, or *Haut-contre*.

A *bene placito*, at Pleasure.

ACCENTOR, one of three Singers in Parts, or the Person that sings the predominant Part in a *Trio*.

ACCORD, from the *French Corde*, a String or Chord, is thus called on Account of the agreeable Union of the Sounds of two Strings, struck at the same Time, whence also some of the Consonances in *Musick* come to be called *Tetrachords*, *Hexachords*, &c. which are Fourths and Sixths.

M. *Carree*, in the *Memoirs of the Royal Academy of Sciences*, lays down a new general Proposition of the Proportions which two Cylinders are to have in order to form the Accords or Consonances in *Musick*. He says, that the solid Cylinders, whose Sounds yield those Accords, are in a triplicate and inverted Ratio of that of the Numbers, which express the same Accords. Suppose, for Example, two Cylinders, the Diameter of whose Basses and Lengths, are as 3 : 2, 'tis evident, the Solidities will be in the Ratio of 27 : 8, which is the triplicate Ratio of 3 : 2, we say, that the Sounds of those two Cylinders will produce a Fifth, which is expressed by those Numbers, and that the biggest and longest will yield the grave Sound, and the smallest the acute one; and the like of all others.

ACCRESSIMENTO, signifies Augmentation, as *Punto d'Accressimento*, Point of Augmentation.

ACUTE, is understood of a Sound or Tone, which is shrill or high in Respect of some other. In this Sense the Word stands opposed to *Grave*. Sounds considered as acute and grave, *i. e.* in Relation of Gravity and Acuteness, constitute what we call Tune, the Foundation of all Harmony.

ADAGIO, is one of the Words used by the *Italians*, to denote a certain Degree or Distinction of Time. — The *Adagio* expresses a slow Time, slowest of any except grave. — The Triples $\frac{3}{4}$, $\frac{3}{8}$, are ordinarily *Adagio*.

A DUE, or *Doi*, *Tre*, a *Quarto*, &c. signifies for two, for three, for four, &c.

ALLEGRETTO, a Diminutive of *Allegro*, which therefore means pretty quick, but not so quick as *Allegro*.

ALLEGRO, is used to signify, that the *Musick* ought to be performed in a brisk, lively, gay, and pleasant Manner, yet without Hurry and Precipitation, and quicker than any except *Presto*. The usual six Distinctions succeed each other in the following Order, *Grave*, *Adagio*, *Largo*, *Vivace*, *Allegro*, and *Presto*.

Note, That the Movements of the same Name as *Adagio*, or *Allegro*, are swifter in Triples than in common Time; the Triples $\frac{3}{4}$ is *Adagio*, *Allegro*, or *Vivace*; the Triples $\frac{3}{8}$, $\frac{3}{16}$, are most commonly *Allegro*. If preceded by *Poco*, it weakens the Strength of its Signification, intimating that the *Musick* must not be performed quite so brisk and lively as *Allegro* would require if it stood alone. If *Allegro* be preceded by *Piu*, it adds to the Strength of its Signification, requiring the *Musick* to be performed more brisk and gay than *Allegro* alone intimated. *Allegro* signifies much the same as *Piu allegro*. *Allegro ma non presto*, brisk and lively, but not too hastily.

ALT, from the *Latin Alto*, is a Term applied to the high Notes in the Scale.

ANDANTE, from the Verb *Andare*, to go, signifies, especially in thorough Basses, that the Notes are to be played distinctly.

ANTHEM, is a Church Song, performed in Cathedral and other Service, by the Choristers, divided for that Purpose into two Chorus's, who sing alternately. The Word at first was used both for Psalms and Hymns, when thus performed. St. Ignatius is by *Socrates* represented as the Author of this Way of singing among the *Greeks*; and among the *Latins* St. Ambrose. Theodoret attributes it to *Diodorus* and *Flavian*. Amalarius Fortunatus has wrote expressly of the Order of Anthems. At present the Term is used in a somewhat narrower Sense, being applied to certain Passages taken out of the Psalms, &c. and accommodated to the particular Solemnity in Hand.

APOTOME, is the remaining Part of an entire Tone, after a greater Semi-Tone has been taken from it. The Proportion in Numbers of the *Apotome* is 2048, 2187.

APOGIATURA, is when in any Part of a Song there are two Notes that are some Distance from one another, as a Third or Fifth; and in playing such Passage, the Musician puts in small intermediate Notes, ascending or descending.

ARSIS and THESIS, are *Greek* Terms used in Composition; as when a Point is inverted or turned, 'tis said to move *per Arsin* and *Thesin*, i. e. when a Point rises in one Part, and falls in another, or falls in one Part, and rises in another, whence is produced an agreeable Variety, tho' properly speaking, 'tis also the Rise and Fall of the Hand beating the Time.

ATTO, an Act, as of a Play, Opera, &c. *Atto di Cadenza* is a certain Disposition of the Sounds or Notes, which not only make a Cadence in one Part, but directs and points out in others; as when the Bass rises a Fourth or falls a Fifth, this Motion is really a Cadence, and at the same Time is a Sign that the other Parts thereupon perform their proper Cadence.

B.

B. Signifies *Bass* or *Basso*. B. C. denotes *Bass continue*.

BAR, is a Stroke drawn perpendicularly across the Lines of a Piece of *Musick*, including between each two, a certain Quantity or Measure of Time, which is various as the Time of the *Musick* is either triple or common. In common Time, between each two Bars, is included the Measure of four Crotchets; in triple, three. The principal Use of the Bars is to regulate the beating or measuring of Time in a Concert.

BQUADRO, or *Quadrato*, or *Durale*, in *French* called *Bquarre*, is what the *English* call B natural or sharp, in Distinction to B *mol*, or Flat \flat . As to the Flat, when placed before any Note, denotes that Note to be lower'd a Semi-Tone Minor, so does the *Quarre* raise it to its natural or diatonick Situation. Again, if the Flat be placed before a Note in the thorough Bass it intimates, that its Third is to be Minor, and if placed with any Cypher over a Note in the Bass, as Flat 6, or Flat 5, &c. It denotes that the Sixth or Fifth thereto are to be flat. But if the Quadro be placed over any Note, or with any Cypher is the thorough Bass, it has the contrary Effect; for thereby the Note or Interval thereto is raised to its natural Order. Both these Characters are used in other Parts, besides the thorough Bass, wherein they affect only the Note to which they are prefixed, i. e. they either raise or lower that Note alone.

C.

C denotes the highest Part in thorough Bass. Again, a simple C or Semi-circle, placed after the Cleft, intimates, that the *Musick* is in common Time, which is either quick or slow, as it is joined with *Allegro*, or *Adagio*. If the C or Semi-circle be crossed thus \overline{C} , or turned thus \overline{P} , the first requires that the Air be played quick, and the last very quick.

CADENCE, from the *Latin* *Cadencia*, a Fall, may be defined in the modern *Musick*, a certain Conclusion of a Song, or of the Parts thereof in many Places of the Piece, which divide it, as it were, into so many Numbers or Periods. The *Cadence* is when the Parts fall or terminate on a Chord or Note, the Ear seeming naturally to expect it; and is much the same in a Song as a

Period, that closes the Sense in a Paragraph of a Discourse. A *Cadence* is either perfect or imperfect; a perfect *Cadence* is that which consists of two Notes sung after each other, or by Degrees conjoined in each of the two Parts: It is called perfect, because it satisfies the Ear better than the other. The *Cadence* is said to be imperfect, when its last Measure is not in Octave or Unison, but a Sixth or a Third; as when the Bass instead of descending a Sixth, descends only a Third; or when descending a Fifth, is the same Thing, rising a Fourth, it makes an Octave with the Treble in the first Measure, and a third Major with the Second. It is called imperfect, because the Ear does not acquiesce in the Conclusion, but expects a Continuation of the Song. The *Cadence* is said to be broken, when the Bass, instead of falling a Fifth, which the Ear expects, raises a Second, either Major or Minor. Every *Cadence* is in two Measures; sometimes it is suspended, in which Case it is called a *Repose*, and only consists of one Measure, as when the two Parts stop at the Fifth, without finishing the *Cadence*. M. Bourseau distinguishes two Kinds of *Cadences*, with Regard to the Bass Viol, i. e. a *Cadence* with and without a Rest. The *Cadence* with a Rest, is when the Finger which should shake the *Cadence*, stops, a little before it shakes, on the Note immediately above that which requires the *Cadence*. The *Cadence* without a Rest, is when that Stop is omitted. There are also *simple* and *double* *Cadences*. The *double* ones again are various; the more *double* are those made after a long Stop, the less *double* those after a short one.

CANCHERIZANTE, or *Cancherizato*, is an *Italian* Word signifying a Piece of *Musick* that begins at the End, being a retrograde Motion from the End of a Song, Air, or Tune, to the Beginning.

CANONE, is a Rule or Method of determining the Intervals of Notes. It is also a short Composition of two or more Parts, in which one leads, and the other follows.

CANONE MIUSO, or *Canone in Corpo*, is a perpetual Fugue written on a single Line, with some Marks to shew when the Part that imitate are to begin and end.

CANONE IN PARTITO, or *Risoluto*, is when all the Parts to a Canon or perpetual Fugue, are writ, or in Partition in several separate Lines, or in separate Parts, with the Pauses which each Part ought to observe at the Beginning.

CAPELLA, properly signifies *Chapel*; but the *Italians* take that Word for an Assembly of Musicians, capable to sing or play all the Parts of a Concert; therefore that Word of *Capella*, by the *Chapel*, shews, that all the Voices and Instruments of a Concert must sing and play together the same Parts, even in the Entries of the Fugues: It is what the *French* call *Grand Chœur*, *Grand Chorus*. What is sung *Da Capella* is ordinarily under the Sign \overline{C} , and marked *Alla-breve*; which signifies that the Measure must be beat at two Times very quick, unless it be marked otherwise. Whence the *Italians* call *Maestro di Capella*, what we call Master of *Musick*.

CHORO, *Chœur*, or *Chorus*. is often found alone, instead of *Tutti*, or *Da Capella*, a *doi*, a *tre*, *quattro*, *Chori*, &c. is *two*, *three*, or *four* *Chorus*'s. When after the Word *Chorus*, we find *primo*, or I^o. we must understand, that it is to be played in the first *Chorus*; if 2d. II^o. or *Secundo*, in the 2d; and consequently, that the Composition is for eight Voices, or different Parts.

CHROMA, *Chrome*, is a *Greek* Term which signifies Colour or Ornament, which the *Italians* use to name a *Crotchet*. Eight of them are wanted for one Measure. They call the double *Crotchet* *Semi-Chroma*, 16 of which are wanted for one Measure. They make use, likewise, of *Dodupla di Chroma*, 12 of which go for one Measure; of *Nonupla di Chrome*, 9 for one Measure; of *Sestupla di Chrome*, 6 of them for one Measure.

CITRA, *Cypher*, is the Name given by the *Italians* to the Numbers and other Signs, placed over the Notes in the thorough Bass, to mark the Nature of the Accords to be made in the Accompaniment.

CIRCOLO, signifies a Circle; and is the Name given by the *Italians* to a Kind of double C, or O seen in ancient *Musicks* after the Key.

CIRCOLO MEZZO, a Kind of Diminution of four Quavers,

Quavers, or Semiquavers, or Notes of equal Value, which represent a Semi-circle, proceeding by conjoint Degrees, fig. 47.

CODA, *Tail*, we often find at the End of a Canon or Fugue, two or three Measures to end with, after having repeated them several Times, and this the *Italians* call *Coda*, it serves only to end the Piece, which without it might be carried on to Infinity.

COMMA, is the smallest of all the sensible Intervals of Tunes, and is about the tenth Part of a Tone. Mr. *Sauveur* says a *Comma* is the Difference between a Tone Major and Minor. It is seldom used, except in the Theory of *Musick*, to shew the Justness of the Con-cords; for in Practice the Division is drowned and lost; each lesser Tone ordinarily contains ten *Comma's*. *Lancelot* divides the Tone into nine *Comma's*, so that according to him a *Comma* is the ninth Part of a Tone—The Proportion of the greater *Comma* in Numbers, is 50:81, that of the smaller is 2025 to 2048.

D.

D. Majuscule, in the B, C, mark what the *Italians* call *Discanto*, and intimates that the Treble ought to play alone, as T does the Tenor, and B the Bass.

DEDUCTIONE, from the Latin *deductio*, is the Name which *Guido Aretin* gave to the Rise of the Voice in pronouncing the Syllables, *ut, re, mi, fa, sol, la, quia per has deducitur vox*; as on the contrary, when the Voice descends by these, *la, sol, fa, mi, re, ut*, he called it *reductio, quia per has reducitur vox*.

E.

E, on the Key of an Organ or Harpsichord, denotes the Note or Sound *E la mi*.

EPISYNAPHE, says *Bacchius*, Senior, is when three Tetrachords or Fourths are sung one after another, without any Disjunction, as when we proceed from the *Hypaton* Tetrachord to *Meson*, and then *Synemmenon*, between which there is no diezentick Tone.

EPITRITO, the same as *Sesqui-terza*, a certain mathematical Proportion, whereby they measure two unequal Numbers, in which the greater contains the less twice, and a third Part of the less remains, as 4 contains 3 once and an Unity over, which is one Third of three, or the less Number; and 8 contains 6 once, and 2 over, which is still one Third of six.

F.

F often stands for the Word *Forte*.

F, or *fa*, is the Bass Key placed at the Beginning of the Lines of a Piece of *Musick*, generally on the fourth Line upwards, also on the third and on any other at Pleasure. Indeed the Characters wherewith the F and C Keys are marked, bear no Resemblance to those Letters: Mr. *Malcolm* thinks it would be well if we used the Letters themselves, but Custom has carried it otherwise; the ordinary Character of the F Key is C : which *Kelper* takes a World of Pains to deduce, by Corruption from the F itself.

FUGUE, is when the different Parts of a musical Composition follow each other, each repeating what the first had performed. If the *Fugue* be made through the Piece, 'tis called *Fuga in consequenza*, or *Canone*; but if only in Part of the Piece, and the Instrument repeats the same Intervals, either above or below, 'tis then called *Fuga in unisono*, and if made an Octave, Fifth or Fourth above or below the Guide or Subject, 'tis said to be *Fuga ad octavam, quintam, or quartam*. All the other Manners of Repetitions, *ad secundam, tertiam, sextam, &c.* higher or lower, are only esteemed Imitations, in which the Intervals of the Guide perhaps may not be exactly observed.

There are three Kinds of *Fugues*, the *simple, double,* and *counter Fugues*.

The *single*, or *simple Fugue*, is some Point consisting of four, five, or more Notes, began by one single Part, and seconded by a Second, Third, Fourth, Fifth, &c. (if the Composition consists of so many) repeating the same, or such like Notes, *i. e.* in the same Proportions, so that the several Parts follow, or come in one after another in the same Manner, the leading Part flying before those that follow.

Fugue double, or *fuga doppia*, is when two or more different Points move together in a *Fugue*, and are alternately mixed and interchanged by the several Parts.

The *counter Fugue*, is when the Guide descends, and the other instead of imitating it in descending, imitates it in ascending.

Fugue authentick, is when the Notes of the Subject ascend, and when they descend, it is a *Fugue plagal*.

Fugue grave, is a Fugue whose Notes are of a long Value, and the Movements slow.

G.

G, is used to signify the Key of the highest Part, called the Treble, or in alt.

GUIDA, the *Guide*, or leading Voice or Instrument in a Piece of *Musick* in Parts; in *Fugues* it is called *dux*, and the Parts that are to imitate and follow, are said to be its *Comés*, or as the *Italians* say, *in consequenza*.

H.

Habitus and *differentia*, are Terms made use of by *Nicomachus*, to distinguish a Sort of Proportion. '*Habitus*', says he, is a Ratio measuring any Interval, and '*Difference*' is the Excess or Defect of the Sounds, with regard to one another. Some are of Opinion, adds he, that *habitus* and *differentia* are the same Things; but they are in the wrong, for one has the same Difference to two, as two to one, but not the same *Habitus*; for in two one is doubled, but one contains but half of two.'

HEMIOLIA, otherwise *Sesqui-alteral*, is a Sort of Proportion, wherein the larger Number contains the smaller one, and a Moiety remains, as 1:2; 6:4, &c. This Name is more especially given to a Species of Triples wherein all the Notes are black. The square one contains two Times, and the lozenge but one; and two black ones with a Tail (called Crotchets by the *English*) are required to make a Time equal, to what is expressed by the Lozenge. This is called *Hemiola maggiore*, because in this the Measure is beat low. And if the Note of the greatest Value be a black or Lozenge, it is equal to two Times, and the *English* Crotchet is half thereof; when this happens the Measure is beat quick, and called *Hemiola minore*. But be these Notes square or lozenge it is not necessary to place any Sign of triple Time before them, the Colour and Figure of them distinguish it enough; and when those Notes come to be white, 'tis not necessary to put a Mark to shew that the Measure changes, and that it is in common Time.

I.

IMITAZIONE, signifies *Imitation*, which is when a Part imitates the Tune of another Part, either during a whole Piece, and then it is a Species of the Canon, or only during some Measure, then it is a *simple Imitation*. Sometimes the Movement only, or the Figure of the Notes is imitated; and that, either by a contrary Movement, which is called an *inverted Imitation*, or in *retrograding*, which is *imitatione cancherizata*. *Imitation* differs from a *Fugue* in regard to the former, the Repetition must be a Second, Third, Sixth, Seventh, or Ninth, either above or below the first Guide or Voice, to which it can be added that it may be at any Interval, and differs properly from *Fugue*, in that in *Imitation*, the Intervals may not be precisely the same; whereas where the Repetition to an Unison, Fourth, Fifth, or Octave, and the Intervals exactly the same in the *Comés* and *Guida*, it would be a *Fugue*.

K.

KEY, a certain fundamental Note or Tone, to which the whole Piece be it Concerto, Sonata, Cantata, &c. is accommodated; and which it usually begins, but always ends.

L.

LARGO, a slow Movement, *i. e.* one Degree quicker than grave, and two than *adagio*.

M.

MONOCHORD, is a musical Instrument wherewith to try the Variety and Proportion of musical Sounds. It is composed of a Rule divided and subdivided into divers Parts, whereon there is a String pretty well stretched upon two Bridges, at each Extream thereof: In the Middle between both, is a moveable Bridge, by whose Means in applying it to the different Divisions of the Line, you find that the Sounds are in the same Proportion to one another, as the Division of the Line cut by the Bridge were. The *Monochord* is called also the harmonical Canon, or the *canonical Rule*, because serving

to measure the Degrees of Gravity and Acuteness.

MOTO, or more properly, according to *Zarlin*, *Movimento*, is a Term that has different Significations in *Musick*; sometimes it means only a Motion or Passage, from one Note to another, at whatsoever Distance, as a second, third, or any other Interval; and is the same whether the intermediate Degrees (if any there be) be founded, or only the Extremes of them, as the first and last Sound of any given Interval.

Sometimes it regards the Quickness and Slowness of such Motion, as a brisk, slow, lively, or languid Motion, and in this Sense it is used with regard to Minuets, Gavots, Sarabands, &c. But the most common, and indeed the most important Acceptation of the Word, is with respect to Harmony, those above described only regarding Melody. With regard to Harmony, 'tis the comparing the Manner wherein an upper or treble Part moves from one Sound to another, with that wherein a lower or Bass Part moves, which is to be done three Ways.

The first is when the upper and lower Parts move both the same Way, either upwards or downwards, and is called *motoretto*.

The second is when in comparing the upper with the lower Part, the one ascends when the other descends, or *è contra*, and this is therefore *moto contrario*.

The last, is when one of the Parts hold out, or continues a Sound, while the other rises or falls on any Note whatsoever; this makes what the *Italians* call *moto obliquo*.

N.

NONUPLA, is a quick Time, peculiar to Jiggs. This Species of Time is otherwise called the Measure of nine Times, which requires two Falls of the Hand and one Rise. There are two Sorts of *Nonupla's*.

The first is *nonupla di semi-minime*, or *dupla sesquiquarta*, thus marked $\frac{1}{4}$, where nine Crotchets are to be in the Bar, of which four make a Semi-breve in common Time, *i. e.* in the down Stroke six, and but three up; it is usually beat *adagio*.

The second, is *nonupla di crome*, or *sesqui ottava*, marked thus $\frac{2}{8}$, wherein nine Quavers make a Bar, instead of eight in common Time, *i. e.* six down and three up; 'tis beat *presto*.

The last, is *nonupla di semi-crome*, thus distinguished $\frac{3}{16}$, in which nine Semi-quavers are contained in a Bar, wherein sixteen are required in common Time, six down and three up; 'tis ordinarily beat *prestissimo*. Besides these there are two other Species of *Nonuplas*.

O.

O, Majuscule, or Circle, or double C, or Semi-circle, is a Note called by the *English* a Semi-breve, by the *Italians* *Circolo*, with which they mark what they call *tempo perfetto*, and the *English* *triple Time*.

OBLIGATO, signifies for, on purpose for, or necessary, or *doi Violini obligato*, that must be played with a Bassoon, &c.

Sometimes it signifies constrained or restrained by certain Rules, subjected to certain Limits or Laws, in order to perform some particular Thing, to give some particular Expression of a Passion, Action, &c. in this Scale we say, *contrapunto obligato*, *fuga obligata*. In this Sense we also say, the Bass is *obligato*, when it is only a Ground of a certain Number of Bars, which are to be repeated over and over; such is the Bass to Chacones, and every Bass wherein one is obliged to keep a certain Movement, and to perform only certain Notes, &c.

OBLIQUO, *oblique*, when the Word is joined to *nota*, it signifies two Breves tied together, which make but one Body, whence 'tis named in Italian *nota dun corpo solo*; sometimes there is a Tail on the right or left Side, either ascending or descending. However it be the two Extremes mark the Sounds, the Middle serves only to tie them.

OCTAVE, is an harmonical Interval, consisting of seven Degrees, or less Intervals.

The most simple Perception we can have of two Sounds is that of Unisons; in regard the Vibrations there begin and end together. The next to this is the *Octave*; where the more acute Sounds make precisely two Vibrations, while the grave or deeper one makes one; and wherein, by Consequence, the Vibrations of

the two meet at every Vibration of the more grave: Hence Unison and *Octave* pass almost for the same Concord.

OVERTURE, or *OVERTURE*, *Opening*, or *Preluding*, a Term used for the Solemnities at the Beginning of an Act or Ceremony, as of an Opera, Tragedy, Comedy, Concert of *Musick*, &c.

The *Overture* of the Theatre in *France*, is a Piece of *Musick* which has usually a Fugue in the second Movement.

P.

P; in the *Italian* *Musick*, frequently signifies *piano*, which is what we call *soft*.

PRESA, is, in general, a Mark, which shews a Musician whereby, or how he must begin, or play; but in particular, *Fugues*, and, particularly, *Canons*, are made of it. This Mark is placed over the Note, on which the second Voice, which is to imitate the first, must begin. If there be another, it is where the third Voice must begin, &c.

PRESTO, signifies quick; *i. e.* that the Measure must be accelerated, and the Time render'd very short; which denotes Gaiety, Passion, Rage, Rapidity, &c.

PRESTO, or *Prestissimo*, signifies very quick.

PROPORTIONE, *Proportion*, *i. e.* the Report found between two Terms, as between two Numbers, or two Lines, or two Sounds, after they have been compared together, as between the Sound *ut* downwards, and the Sound *sol* upwards. There are, in general, two Sorts of *Proportions*, the first called *Proportion of Equality*, and the second *Proportion of Inequality*.

The *Proportion of Equality*, is when the two Terms are equal, or one contains no more Parts than the other; as 1 to 1, 2 to 2, 8 to 8.

The *Proportion of Inequality*, is when one of the Terms is greater, *i. e.* contains more Parts than the other; as the *Proportion* of 4 to 2, is a *Proportion of Inequality*, since the first Term contains four Units, and the second contains but two. This second *Proportion* is the only one used in *Musick*; and can be made in five Manners, called by the *Italians* *generi*, or *general*.

The first is called *Moltiplice*, or *Multiple*; and is when the greater Term contains the smaller more than once; as the *Proportion* of 4 to 2, is a *multiple Proportion*, because 4 contain twice 2, and that justly, and without any Thing remaining. If the greater Term contains the smaller but twice, as 4. 2, or 6. 3, or 16. 8, &c. that's called *proportio dupla*, or *double Proportion*. If it contains it just three Times, as 3. 1. or 6. 2. or 9. 3, &c. that's called *proportio tripla*, or *triple Proportion*. If it contains it four Times, as 4. 1. or 8. 2. or 12. 3. it is *proportio quadrupla*, or *quadruple Proportion*, and thus *in infinitum*.

The second *Proportion of Inequality*, is *proportione del genere super-particolare*; which is when the greater Term contains the smaller once only, and besides precisely one of the Parts of that smaller, as 3. 2. for three contains two once, and an Unit besides, which is one of the Parts of two; but if that Part remaining is precisely half of the smaller Number, as 3. 2. that *Proportion* is that otherwise called *sesquialtera*: If that Part remaining is the third Part of the smaller Number, as 4. 3. that is called *sesqui terza*: If it be the fourth Part, as 5. 4. it is called *sesqui quarta*; and thus *in infinitum*, adding always to *sesqui* the ordinal Number of the smallest Term.

The third *Proportion of Inequality*, is, *Proportione del genere super-parziante*; which is when the greater Term contains once the less, and besides two, or three, or four, &c. of the Parts which compose the lesser, *i. e.* properly, according to *Zarling*, two, or three, or four Units, &c. which is marked in placing the Word, *in* for 2. *tri*, for 3. *quattri* for 4, &c. between *super* and *parziante*. After which the ordinal Number of the smaller Term is added: Therefore the *Proportion* between 5 and 3, is to be called *Super-bi-parziante terza*, because 5 contains once 3, and two Units besides, which are Parts of 3. Likewise the *Proportion* of 7 to 4, is called *Super-tri-parziante quarta*, because 7 contains once 4, and 3 of its Parts, or 3 Units. Likewise the *Proportion* of 9 to 5, must be called *Super-quadrupla parziante quinta*, because the Number contains once 5, and 4 of its Parts, or 4 Units.

besides 4 of the Parts of 5, or 4 Units, and thus of the others.

The 4th and 5th Proportion, of Inequality, are composed of the Multiple, and of one of the two above-mentioned; but we'll take no Notice of them here, because the three we have explained already, are sufficient for the Practice of *Musick*, and to explain which are the Forms and Roots of all the *Consonances* and *Dissonances* of the *Musick*, as is plainly seen in the following Table.

TABLE OF PROPORTIONS.

| <i>Consonances.</i> | | | |
|--|--|---|---------|
| The Octave The Fifth The Fourth The 3d Major The 3d Minor The 6th Major The 6th Minor | draws its Origin and Form from the Proportion | <i>Double</i> | 2. 1. |
| | | <i>Sesqui-Altera</i> | 3. 2. |
| | | <i>Sesqui-Terza</i> | 4. 3. |
| | | <i>Sesqui-Quarta</i> | 5. 4. |
| | | <i>Sesqui-Quinta</i> | 6. 5. |
| | | <i>Super-bi-parziente-Terza</i> | 5. 3. |
| | | <i>Super-tri-parziente-Quinta</i> | 8. 5. |
| | | <i>Dissonances.</i> | |
| The 7th Major The 7th Minor The false Fifth The Tritone The Tone Maj. or 2d Major The Tone Min. The Semi-Tone Maj. or 2d Min. The Semi-Tone Minor The Comma | draws its Origin and Form from the Proportion | <i>Super 7^o parziente Octava</i> | 15. 8. |
| | | <i>Super-meadri-parziente Quint.</i> | 9. 5. |
| | | <i>Super 14^o parziente, 45^a</i> | 64. 45. |
| | | <i>Super 13^o parziente, 32^a</i> | 45. 32. |
| | | <i>Sesqui-Octava</i> | 9. 8. |
| | | <i>Sesqui-Nona</i> | 10. 9. |
| | | <i>Sesqui 15^a</i> | 16. 15. |
| | | <i>Sesqui 24^a</i> | 25. 24. |
| | | <i>Sesqui 8^a</i> | 80. 81. |

But it must be observed, besides, that all we have said on this Subject, must be understood when the greater Number is compared with the smaller; and consequently that it is wrote the first thus 3. 1. or over it thus $\frac{3}{1}$; for if on the contrary the smaller was to be compared with the greater, then the smaller Number should be put before, or over the greater, thus 1. 3. or thus $\frac{1}{3}$. And to denominate their Proportions, nothing else is to be done, than to place *Sub.* before the Denominations heretofore explained; which will be sufficient to shew that the smaller Number is compared with the greater. For Instance, *proportio tripla* is marked thus, 3. 1. or $\frac{3}{1}$; and *proportio sub tripla* thus, 1. 3. or $\frac{1}{3}$, &c.

We must observe, besides, that the *Italians* call of the general Name *Proporzioni*, *Proportions*, all the Species of Triples, mentioned in this Treatise.

Q.

QUADRATO, or QUADRO, which signifies *quarre*, *Square*, is the Epithet given to *b*, when it is a diatonic, natural, or figured Sign; and then its Effect is to restore the Chords, changed by the Diezis, or *b mol* to their natural Situation, and therefore to raise of a Semi-Tone, the Note which the *b mol* had lowered; and to lower of a Semi-Tone that which the Diezis had raised.

R.

RIPRESO, is the Name given by the *Italians* to what we call the Parts of the grand Chorus, and whereby they distinguish those of the little Chorus, and therefore multiply neither the Harmony nor the Number of Parts. They are properly but Extracts of Recitant Parts, where Pauses are placed instead of Recitative, writing only what is to be sung by all the Musicians, or *Da Capella*, which is ordinarily marked by the Words *tutti*, *omne*, or *all*.

RIPRESA, is what we call in *Latin*, *Signum repetitionis*; because the *Ripresa* in *Musick* is properly a Sign or Mark, that something is to be repeated. There are two Sorts of *Ripresa*, viz. *Ripresa maggiore*, and *minore*, i. e. the great and small *Ripresa*.

The great *Ripresa* is marked thus || or thus, — and signifies, that all that has been || play'd or sung thus far, must be repeated, if it be the Beginning of a Piece; or all that has been play'd or sung from such a Mark, if it be at the End of a Piece; and what is thus sung twice, is called *Ripresa*. Those Signs are commonly found towards the third Part or thereabouts of Gavots, Minuets, Courants, &c. and at the End; because those Pieces must have two *Ripresa's*; which must each be played twice. Some will have it, that when the *Ripresa* has Points on both Sides, thus || it suffices to mark the Repetition, as well of what has preceded it, as of what follows it. That when it has Points on the left Side thus || it is for the Repetition of what precedes it; and when on the right Side thus || it is the Repetition of what follows.

The *Ripresa minore*, is when only few Measures of the *Ripresa maggiore* are repeated. It is marked thus || or thus || over or under the Note, whereby one must begin the Repetition.

RIVOLTARE, signifies to *change*, as well in the Harmony as in the Parts. Therefore *Canto rivoltato*, is a *Treble changed*, which after it has served of *Treble*, serves of *Bass*. *Basso rivoltato*, is a *Bass*, which after it has served of *Bass*, serves of *Treble*, &c. It is in that Sense we often find these Expressions in Authors, *la sesta Rivoltata diviene settima*, &c. the sixth changed becomes a seventh, &c. This Change is called *al*, or *per Roversa*, for Instance, fig. 50.

S.

SOLFAING, the naming or pronouncing the several Notes of a Song, by the Syllables *ut*, *re*, *mi*, *fa*, *sol*, and in learning to sing.

Of the seven Notes in the *French Scale*, *ut*, *re*, *mi*, *fa*, *sol*, *la*, *si*, only four are used by the *English* in Singing, as *mi*, *fa*, *sol*, *la*, though the *Italians* use the six first. Their Office therein is, that by applying them to every Note of the Scale, it may not only be pronounced with more Ease, but chiefly that by them the Tones, and Semi-Tones of the natural Scale, may be better marked out and distinguished.

The *English* say, that this Design is obtained by the four Syllables, *mi*, *fa*, *sol*, *la*; that thus from *fa* to *sol*, is a Tone, also from *sol* to *la*, and *la* to *mi*, without distinguishing the great and less Tone, but from *la* to *fa*, also from *mi* to *fa*, only a Semi-Tone; that if then these be applied in this Order *fa sol la fa sol la mi fa*, they express the natural Series from C, and if they be repeated a second or third Octave, we see by them how to express all the different Orders of Tones and Semi-Tones in the diatonic Scale; and still above *mi* will stand *fa*, *sol*, *la*, and below it the same inverted *la*, *sol*, *fa*, and one *mi* is always distant from another an Octave, which cannot be said of any of the rest, because after *mi* ascending, come always *fa*, *sol*, *la*, *fa*, which are repeated invertedly descending.

To conceive the Use of this, it is to be remember'd, that the first Thing in learning to sing, is to make one raise a Scale of Notes by Tones and Semi-Tones to an Octave, and descend again by the same, and then to rise and fall by greater Intervals, as at a Leap, as Thirds and Fourths, &c. and to do all this by beginning at Notes of different Pitch; then these Notes are represented by Lines and Spaces, to which these Syllables are applied, and the Learners taught to name each Line and Space thereby; which makes what we call *Solfaing*. The Use whereof is, that while they are learning to tune the Degrees and Intervals of Sounds, expressed by Notes on a Line or Space, or learning a Song, to which no Words are applied, they may do it the better by Means of articulate Sounds; but chiefly that by knowing the Degrees and Intervals, expressed by those Syllables, they may more readily know the Places of the Semi-Tones, and the true Distance of the Notes.

T.

T stands for *Tutti*, *all*, or *all* together. — It is also used to mark the Tenor, and the Figures 1^o, 2^o, to signify the first and second Tenor.

The Letter T, or *tr*, is also used likewise to signify a Shake to be made on any Sound, and is placed over the Note to be shook on.

to measure the Degrees of Gravity and Acuteness.

MOTO, or more properly, according to *Zarlin*, *Movimento*, is a Term that has different Significations in *Musick*; sometimes it means only a Motion or Passage, from one Note to another, at whatsoever Distance, as a second, third, or any other Interval; and is the same whether the intermediate Degrees (if any there be) be founded, or only the Extremes of them, as the first and last Sound of any given Interval.

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The first is when the upper and lower Parts move both the same Way, either upwards or downwards, and is called *motoretto*.

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N.

NONUPLA, is a quick Time, peculiar to Jiggs. This Species of Time is otherwise called the Measure of nine Times, which requires two Falls of the Hand and one Rise. There are two Sorts of *Nonupla's*.

The first is *nonupla di semi-minime*, or *dupla sesquiquarta*, thus marked $\frac{1}{4}$, where nine Crotchets are to be in the Bar, of which four make a Semi-breve in common Time, *i. e.* in the down Stroke six, and but three up; it is usually beat *adagio*.

The second, is *nonupla di crome*, or *sesqui ottava*, marked thus $\frac{2}{8}$, wherein nine Quavers make a Bar, instead of eight in common Time, *i. e.* six down and three up; 'tis beat *presto*.

The last, is *nonupla di semi-crome*, thus distinguished $\frac{1}{16}$, in which nine Semi-quavers are contained in a Bar, wherein sixteen are required in common Time, six down and three up; 'tis ordinarily beat *prestissimo*. Besides these there are two other Species of *Nonuplas*.

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O, Majuscule, or Circle, or double C, or Semi-circle, is a Note called by the *English* a Semi-breve, by the *Italians* *Circolo*, with which they mark what they call *tempo perfetto*, and the *English* *triple Time*.

OBLIGATO, signifies for, on purpose for, or necessary, or *doi Violini obligato*, that must be played with a Bassoon, &c.

Sometimes it signifies constrained or restrained by certain Rules, subjected to certain Limits or Laws, in order to perform some particular Thing, to give some particular Expression of a Passion, Action, &c. in this Scale we say, *contrapunto obligato*, *fuga obligata*. In this Sense we also say, the Bass is *obligato*, when it is only a Ground of a certain Number of Bars, which are to be repeated over and over; such is the Bass to Chacones, and every Bass wherein one is obliged to keep a certain Movement, and to perform only certain Notes, &c.

OBLIQUO, *oblique*, when the Word is joined to *nota*, it signifies two Breves tied together, which make but one Body, whence 'tis named in Italian *nota dun corpo solo*; sometimes there is a Tail on the right or left Side, either ascending or descending. However it be the two Extremes mark the Sounds, the Middle serves only to tie them.

OCTAVE, is an harmonical Interval, consisting of seven Degrees, or less Intervals.

The most simple Perception we can have of two Sounds is that of Unisons; in regard the Vibrations there begin and end together. The next to this is the *Octave*; where the more acute Sounds make precisely two Vibrations, while the grave or deeper one makes one; and wherein, by Consequence, the Vibrations of

the two meet at every Vibration of the more grave: Hence Unison and *Octave* pass almost for the same Concord.

OVERTURE, or OUVERTURE, *Opening*, or *Preluding*, a Term used for the Solemnities at the Beginning of an Act or Ceremony, as of an Opera, Tragedy, Comedy, Concert of *Musick*, &c.

The *Ouverture* of the Theatre in *France*, is a Piece of *Musick* which has usually a Fugue in the second Movement.

P.

P; in the *Italian* *Musick*, frequently signifies *piano*, which is what we call *soft*.

PRESA, is, in general, a Mark, which shews a Musician whereby, or how he must begin, or play; but in particular, *Fugues*, and, particularly, *Canons*, are made of it. This Mark is placed over the Note, on which the second Voice, which is to imitate the first, must begin. If there be another, it is where the third Voice must begin, &c.

PRESTO, signifies quick; *i. e.* that the Measure must be accelerated, and the Time render'd very short; which denotes Gaiety, Passion, Rage, Rapidity, &c.

PRESTO, or *Prestissimo*, signifies very quick.

PROPORTIONE, *Proportion*, *i. e.* the Report found between two Terms, as between two Numbers, or two Lines, or two Sounds, after they have been compared together, as between the Sound *ut* downwards, and the Sound *sol* upwards. There are, in general, two Sorts of *Proportions*, the first called *Proportion of Equality*, and the second *Proportion of Inequality*.

The *Proportion of Equality*, is when the two Terms are equal, or one contains no more Parts than the other; as 1 to 1, 2 to 2, 8 to 8.

The *Proportion of Inequality*, is when one of the Terms is greater, *i. e.* contains more Parts than the other; as the *Proportion* of 4 to 2, is a *Proportion of Inequality*, since the first Term contains four Units, and the second contains but two. This second *Proportion* is the only one used in *Musick*; and can be made in five Manners, called by the *Italians* *generi*, or *general*.

The first is called *Moltiplice*, or *Multiple*; and is when the greater Term contains the smaller more than once; as the *Proportion* of 4 to 2, is a *multiple Proportion*, because 4 contain twice 2, and that justly, and without any Thing remaining. If the greater Term contains the smaller but twice, as 4, 2, or 6, 3, or 16, 8, &c. that's called *proportio dupla*, or *double Proportion*. If it contains it just three Times, as 3, 1, or 6, 2, or 9, 3, &c. that's called *proportio tripla*, or *triple Proportion*. If it contains it four Times, as 4, 1, or 8, 2, or 12, 3, it is *proportio quadrupla*, or *quadruple Proportion*, and thus *in infinitum*.

The second *Proportion of Inequality*, is *proporzione del genere super-particolare*; which is when the greater Term contains the smaller once only, and besides precisely one of the Parts of that smaller, as 3, 2, for three contains two once, and an Unit besides, which is one of the Parts of two; but if that Part remaining is precisely half of the smaller Number, as 3, 2, that *Proportion* is that otherwise called *sesquialtera*: If that Part remaining is the third Part of the smaller Number, as 4, 3, that is called *sesqui terza*: If it be the fourth Part, as 5, 4, it is called *sesqui quarta*; and thus *in infinitum*, adding always to *sesqui* the ordinal Number of the smallest Term.

The third *Proportion of Inequality*, is, *Proporzione del genere super-parziante*; which is when the greater Term contains once the less, and besides two, or three, or four, &c. of the Parts which compose the lesser, *i. e.* properly, according to *Zarlin*, two, or three, or four Units, &c. which is marked in placing the Words, *tri*, for 2, *quattri* for 3, &c. between *super* and *parziante*. After which the ordinal Number of the smaller Term is added: Therefore the *Proportion* between 5 and 3, is to be called *Super-bi-parziante terza*, because 5 contains once 3, and two Units besides, which are Parts of 3. Likewise the *Proportion* of 7 to 4, is called *Super-tri-parziante quarta*, because 7 contains once 4, and 3 of its Parts, or 3 Units. Likewise the *Proportion* of 9 to 5, must be called *Super-quadrupla-parziante quinta*, because the Number contains once 5, and 4 of its Parts, or 4 Units.

besides 4 of the Parts of 5, or 4 Units, and thus of the others.

The 4th and 5th Proportion, of Inequality, are composed of the Multiple, and of one of the two above-mentioned; but we'll take no Notice of them here, because the three we have explained already, are sufficient for the Practice of *Musick*, and to explain which are the Forms and Roots of all the *Consonances* and *Dissonances* of the *Musick*, as is plainly seen in the following Table.

TABLE OF PROPORTIONS.

| Consonances. | | | |
|---|--|--|--|
| <div> <div> The Octave The Fifth The Fourth The 3d Major The 3d Minor The 6th Major The 6th Minor </div> <div> draws its Origin and Form from the Proportion </div> </div> | <div> Double Sesqui-Altera Sesqui-Terza Sesqui-Quarta Sesqui-Quinta Super-bi-parziente-Terza Super-tri-parziente-Quinta </div> | <div> 2. 1. 3. 2. 4. 3. 5. 4. 6. 5. 5. 3. 8. 5. </div> | |
| Dissonances. | | | |
| <div> <div> The 7th Major The 7th Minor The false Fifth The Tritone The Tone Maj. or 2d Major The Tone Min. The Semi-Tone Maj. or 2d Min. The Semi-Tone Minor The Comma </div> <div> draws its Origin and Form from the Proportion </div> </div> | <div> Super 7^o parziente Octava Super-meadri-parziente Quint. Super 14^o parziente, 45^a Super 13^o parziente, 32^a Sesqui-Octava Sesqui-Nona Sesqui 15^a Sesqui 24^a Sesqui 8^a </div> | <div> 15. 8. 9. 5. 64. 45. 45. 32. 9. 8. 10. 9. 16. 15. 25. 24. 80. 81. </div> | |

But it must be observed, besides, that all we have said on this Subject, must be understood when the greater Number is compared with the smaller; and consequently that it is wrote the first thus 3. 1. or over it thus $\frac{3}{1}$; for if on the contrary the smaller was to be compared with the greater, then the smaller Number should be put before, or over the greater, thus 1. 3. or thus $\frac{1}{3}$. And to denominate their Proportions, nothing else is to be done, than to place *Sub.* before the Denominations heretofore explained; which will be sufficient to shew that the smaller Number is compared with the greater. For Instance, *proportio tripla* is marked thus, 3. 1. or $\frac{3}{1}$; and *proportio sub-tripla* thus, 1. 3. or $\frac{1}{3}$, &c.

We must observe, besides, that the *Italians* call of the general Name *Proporzioni*, *Proportions*, all the Species of Triples, mentioned in this Treatise.

Q.

QUADRATO, or QUADRO, which signifies *quarre*, *Square*, is the Epichet given to *b*, when it is a diatonic, natural, or figured Sign; and then its Effect is to restore the Chords, changed by the Diezis, or *b mol* to their natural Situation, and therefore to raise of a Semi-Tone, the Note which the *b mol* had lowered; and to lower of a Semi-Tone that which the Diezis had raised.

R.

RIPRINO, is the Name given by the *Italians* to what we call the Parts of the grand Chorus, and whereby they distinguish those of the little Chorus, and therefore multiply neither the Harmony nor the Number of Parts. They are properly but Extracts of Recitant Parts, where Pauses are placed instead of Recitative, writing only what is to be sung by all the Musicians, or *Da Capella*, which is ordinarily marked by the Words *tutti*, *omni*, or *all*.

REPRESA, is what we call in *Latin*, *Signum repetitionis*; because the *Ripresa* in *Musick* is properly a Sign or Mark, that something is to be repeated. There are two Sorts of *Ripresa*, viz. *Ripresa maggiore*, and *minore*, i. e. the great and small *Ripresa*.

The great *Ripresa* is marked thus $\frac{||}{\text{||}}$ or thus, — and signifies, that all that has been $\frac{||}{\text{||}}$ play'd or sung thus far, must be repeated, if it be the Beginning of a Piece; or all that has been play'd or sung from such a Mark, if it be at the End of a Piece; and what is thus sung twice, is called *Ripresa*. Those Signs are commonly found towards the third Part or thereabouts of Gavots, Minuets, Courants, &c. and at the End; because those Pieces must have two *Ripresa's*; which must each be played twice. Some will have it, that when the *Ripresa* has Points on both Sides, thus $\frac{||}{\text{||}}$ it suffices to mark the Repetition, as well of what has preceded it, as of what follows it. That when it has Points on the left Side thus $\frac{||}{\text{||}}$ it is for the Repetition of what precedes it; and when on the right Side thus $\frac{||}{\text{||}}$ it is the Repetition of what follows.

The *Ripresa minore*, is when only few Measures of the *Ripresa maggiore* are repeated. It is marked thus $\frac{||}{\text{||}}$ or thus $\frac{||}{\text{||}}$ over or under the Note, whereby one must begin the Repetition.

RIVOLTARE, signifies to *change*, as well in the Harmony as in the Parts. Therefore *Canto rivoltato*, is a *Treble changed*, which after it has served of *Treble*, serves of *Bass*. *Basso rivoltato*, is a *Bass*, which after it has served of *Bass*, serves of *Treble*, &c. It is in that Sense we often find these Expressions in Authors, *la sesta Rivoltata diviene settima*, &c. the sixth changed becomes a seventh, &c. This Change is called *al*, or *per Roversa*, for Instance, fig. 50.

S.

SOLFAING, the naming or pronouncing the several Notes of a Song, by the Syllables *ut*, *re*, *mi*, *fa*, *sol*, and in learning to sing.

Of the seven Notes in the *French Scale*, *ut*, *re*, *mi*, *fa*, *sol*, *la*, *si*, only four are used by the *English* in Singing, as *mi*, *fa*, *sol*, *la*, though the *Italians* use the six first. Their Office therein is, that by applying them to every Note of the Scale, it may not only be pronounced with more Ease, but chiefly that by them the Tones, and Semi-Tones of the natural Scale, may be better marked out and distinguished.

The *English* say, that this Design is obtained by the four Syllables, *mi*, *fa*, *sol*, *la*; that thus from *fa* to *sol*, is a Tone, also from *sol* to *la*, and *la* to *mi*, without distinguishing the great and less Tone, but from *la* to *fa*, also from *mi* to *fa*, only a Semi-Tone; that if then these be applied in this Order *fa sol la fa sol la mi fa*, they express the natural Series from C, and if they be repeated a second or third Octave, we see by them how to express all the different Orders of Tones and Semi-Tones in the diatonic Scale; and still above *mi* will stand *fa*, *sol*, *la*, and below it the same inverted *la*, *sol*, *fa*, and one *mi* is always distant from another an Octave, which cannot be said of any of the rest, because after *mi* ascending, come always *fa*, *sol*, *la*, *fa*, which are repeated invertedly descending.

To conceive the Use of this, it is to be remember'd, that the first Thing in learning to sing, is to make one raise a Scale of Notes by Tones and Semi-Tones to an Octave, and descend again by the same, and then to rise and fall by greater Intervals, as at a Leap, as Thirds and Fourths, &c. and to do all this by beginning at Notes of different Pitch; then these Notes are represented by Lines and Spaces, to which these Syllables are applied, and the Learners taught to name each Line and Space thereby; which makes what we call *Solfaing*. The Use whereof is, that while they are learning to tune the Degrees and Intervals of Sounds, expressed by Notes on a Line or Space, or learning a Song, to which no Words are applied, they may do it the better by Means of articulate Sounds; but chiefly that by knowing the Degrees and Intervals, expressed by those Syllables, they may more readily know the Places of the Semi-Tones, and the true Distance of the Notes.

T.

T stands for *Tutti*, *all*, or *all* together. — It is also used to mark the Tenor, and the Figures 1^o. 2^o. to signify the first and second Tenor.

The Letter T, or *tr*, is often used likewise to signify a Shake to be made on any Sound, and is placed over the Note to be shook on.

TABLA-

TABLATURA, signifies *Tablature*, which is in general, when to mark the Sounds, the Letters of the Alphabet, Cyphers, and other Signs are used, which is not common in the modern Musick; but this Term is more particularly adapted to the Manner of writing a Piece of *Musick* for the Theorbo, Lute, Guittar, Viol, or the like, which is done on parallel Lines (each of which represents a String of the Instruments) certain Letters of the Alphabet, whereof A marks that the String is to be struck open, *i. e.* without putting the Finger of the Left-Hand on the Neck. B shews that one of the Fingers is to be put on the first Stop, C on the second, D on the third, and so on through the Octave.

The *Tablature* of the *Lute*, is wrote in Letters of the Alphabet, and that of the Harpsichord in common Notes with Figures over their Heads, though the *Germans*, *Saxons*, *Swedes*, &c. who seldom or ever use our Notes, and who have rendered themselves famous for their accurate Practice and Knowledge of this Sort of Writing, use it, not only for the Lute, Bass-viol, &c. but also for the Organ and Harpsichord, placing plain Letters without Lines.

TEMPERAMENT, is what the *Italians* otherwise called *participatione*; wherefore they call the modern System, *Systema temperato*, or *participato*, because founded on Temperature, that is, on the Diminution of some Intervals, and the enlarging of others; which makes it participate of the *diatonick* and *chromatick* Systems.

The better to understand what is meant hereby, 'tis to be observed, 1. That among the Antients, there were three Sects, who had very different Opinions concerning the precise Compass or Extent of each Interval.

The first of these were the *Pythagoreans*, Disciples of *Pythagoras*, who would have it that Reason alone was the proper Judge of Sounds, and their Proportions, and consequently that the Forms of Intervals were all rational, *i. e.* they admitted none but such as they could demonstrate either arithmetically by Numbers, or geometrically by Lines; and that therefore, the fifth must always have the Proportion of 2:3, the fourth that of 3:4, the Tone minor, 9:10, the Tone major that of 8:9, exactly; and besides these they fix'd the Proportions of many other Intervals, which have afforded Disputes for as many Mathematicians.

But the Ear (the Judgment whereof is very nice) does not agree to what they so fixed. The rest in the Course of my Treatise.

TETRACHORD, in the antient *Musick*, a Concord consisting of three Degrees or Intervals, and four Terms or Sounds; called by the Antients also (more properly) *Diateffaron*, and by us a Fourth.

TRANSPOSITION, the writing any Song, Air, or Tune, in any Key different from that in which it was first composed.

Of these there are two Kinds; the first is with respect to the Cleff, and the second with regard to the Key.

Transposition with respect to the Cleff, consists in changing the Places or Seats of the Notes or Letters, among the Lines and Spaces; but so as that every Note be set at the same Letter.

This is done either by moving the same Cleff to another Line, or by using another Cleff; but with Signs that place the Tones and Semitones in the same Order as before, by reason the Piece is in the same Key.

The Practice is easy in the same Case; in the first you take the first Note at the same Distance above or below the Cleff-Note, in its new Position as before; and all the rest of the Notes in the same Relations or Distances from one another, so that the Notes are all set on Lines or Spaces of the same Name.

In the second, or setting the Musick in a different Key, 'tis to be observed, the Places of the three Cleff-Notes, are invincible in the Scale, and are to one another in these Relations, the mean a Fifth above the Bass, and the Treble a Fifth above the Mean.

Now to transpose to a new Cleff, for Example, from the Treble to the Mean, wherever the new Cleff is set, we suppose that the individual Note on the same Place of the Staff, will be the same as that Part in the Composition, to which the new Cleff is originally appropriated, so that it may direct to the same Note we had before transposition. Now from the fixed Relations of the

three Cleffs in the Scale, it will be easy to find the Seat of the first transposed Note, and then all the rest are to be set at the same mutual Distances they were at before.

Suppose, for Example, the first Note of a Song to be D, a Sixth above the Bass Cleff, wherever that Cleff is placed, the first Note must be a greater Second above, because a greater Second above the Mean, is a Sixth above the Bass-Cleff, the Relation between the two being a Fifth; so the first Note will be still the same individual D.

The Use of this *Transposition* is, that if a Song being set with a certain Cleff in a certain Position, the Notes go far above or below the Staff of five Lines, they may by the Change of the same Cleff in the particular System, or by taking a new Cleff, be brought within the Compass of the Lines, or at least more within either Extreme than before.

Transposition from one Key to another, is a changing of the Key, or setting all the Notes of a Song at different Letters, and performing it consequently in different Places upon the Instruments. The Design thereof is, that a Song, which being begun in one Place is too high, too low, or otherwise inconvenient for a certain Instrument, may be begun in another Place, and from that carried on through all its just Degrees. The Cleff and its Position here remain the same, and the Change is of the Notes themselves from one Letter to another, and its Line or Space to another.

In the former *Transposition*, the Notes were expressed by the same Letters, but both removed to different Lines and Spaces; in this the Letters are unmoved, and the Notes of the Song transferred to, or expressed by other Letters, and consequently set on different Lines or Spaces, which therefore require a different Signature of the Cleff.

Transposition then, is the changing the Notes of a Song to a different Species of Octave, to that in which it was first composed, or at least in which 'tis actually noted, in such Sort that the Semitones of the two Fourths, which compose each Octave, as *mi fa*, and as the *French* have *si ut*, may be found by means of \sharp \sharp Flats, or \times \times exactly in the same Range, or in the same Degree or Proportion to another, as before Transposition, for Instance, *fig. 52.* where the Semitones of the Fourth in the Diatonick are found by means of Sharps.

Or 'tis the using one or more chromatick Chords, instead of the natural and diatonick, to constitute a Mode, that is to say, to place the Final on any Degree at Pleasure, or to render the Fifth above it just; and by that Means make it the Dominant, or to make the third Major or Minor, &c.

It must be observed, it is not impossible to transpose a diatonick Song, or one wherein there are none but natural Chords, either higher or lower, without the Aid of these chromatick Signs, either one Flat, or one Sharp, and very often one may not be sufficient; therefore we must remark that if many Flats or Sharps be found in a Song, either immediately after a Cleff, or in different Parts of the Song, on the natural or essential Chords of the Mode, it may be concluded, that the Song is in a transposed Mode, and therefore may be reduced to a natural one.

Lastly, *Transposition* is to use these chromatick Characters in such a Manner, as that by their Help the Chords of the two Octaves, though they begin and continue in different Letters or Degrees of the *Gamm*, may form the same Intervals, and consequently have the same Names. For Instance, *fig. 53.* here are only Examples of *ut* and *re*, because the Finals of all transposed Modes must be one of those two; if *ut*, the third above it is Major; if *re*, Minor.

Note, That the *Transposition* is a Thing which gives a great deal of Trouble to young Practitioners in singing. Sometimes by the Negligence either of Authors or Copists in forgetting to place the chromatick Signs, for a Flat or a Sharp being omitted after the Cleff, makes them mistake in transposing the Air, which they suppose noted in a certain Cleff, which is accidental Flats or Sharps in the Course of the Song shew not to be natural. This *Transposition* neither raises nor lowers the Tone, but changes the Name

only, and reduces a transposed Song to a natural one.

TREMOLO, *Tremolante*, or *Tremante*, is often found either entire, or in abregée, *Trem.* To give Notice, especially to those who play on Instruments with a Bow, to make on the same Degree several Notes with a single Stroke of the Bow, to imitate as it were the Shake of the Organ. That's also often marked for Voices: We have Examples of both in Mr. Lully's Opera of *Isis*.

We find sometimes also, that Word *Tremolo*, and its diminutive *Tremoleto*, to signify what the French call, though improperly, *Cadence*, and which should be called *Shake*.

TRIAS, a Term purely Latin, which signifies *three*, and in antient Musick a *Trio*, i. e. a Composition in three Parts, and to be performed by three Voices alone.

TRIAS HARMONICA, are Greek Terms latinized, which can be translated *Harmonick triad*; and is a Compound of three radical Sounds all heard together, neither of them being at the Octave of the two others; and of which one is a Fifth, and the other a Third above the other, which is the Fundamental.

The *Triad*, is properly a Consonance formed of a Third and a Fifth; which with the Bass or fundamental Sound make three different Terms; whence the Name *Triad*. That of harmonical is doubtless given it from the wonderful Property of the Fifth, which divides itself into two Thirds very naturally, both excellent and perfectly agreeable; so that this one Sound disposed between two others make two Thirds at once, one Major, the other Minor, and of Consequence a double Harmony.

Hence it is, that in *Trios*, particularly this Concord is preferred to that which divides the Octave into a Fifth and a Fourth, in regard that if there be Concord on one Side, there is a Discord on the other, whereas here the Harmony is compleat on both Sides. But here it must be observed, that the Fourth is by some accounted a Discord, but by most esteemed a Concord; and 'twas upon the Division, that a great many of the antient Niceties depended.

Of the three Sounds which compose the harmonical *Triad*, the gravest is called the Fundamental or Bass; the acutest, that is, that which makes the Fifth, and terminates the Concord upwards, is called the excluded or highest Sound, *sonus exclusus*, and that which divides the Fifth so agreeably into two Thirds, the harmonical Mean, *medius harmonicus*.

This Division of the Fifth into two Thirds may be performed two Ways, viz. *First*, harmonically, when the greater Third is lowest, and the less a-top, in which Case the *Triad* is said to be perfect and natural.

Secondly, arithmetically, when the less Third is lowest, and the greater a-top; in which Case the *Triad* is called imperfect or flat; both are good, but the last is not so much used as the first.

TRILLO, often marked, in Abregée, by a T. or by Tr. or only by a small t, as well for Voices as for Instruments; is to intimate, that you must beat very quick alternately, or one after another, two Sounds in conjoint Degrees, as *fa mi*, or *mi re*, &c. so that you begin by the highest, and end by the lowest; and this is properly the *Cadence* or *Shake*, in the French Manner. But it is also very often a Mark, especially in the Italian Musick, that you must be at the same Note several Times on the same Degree, beginning a little slow, and ending with all the Quickness the Throat can form them: For Instance, fig. 56.

Therefore this is properly the true Italian Trillo, at least as it can be expressed by common Notes. The Italians use it more particularly after they have held out a Note, or made a *Roulade* or *Tirata* of two or more Measures to ease the Voice, which so long a Tension had weakened.

Trio, is said of a Piece of Musick made to be performed by three Voices, or of all Composition in three distinct Parts. But in this Composition which is the most, and which ought to be the most regular of all; we must observe, 1. That besides the general Rules of the Counterpoint, which forbid making two Octaves or two Fifths to follow one another, either to the Bass or among the other Parts, in *Trios*, the Third must be heard in every Time of the Bar, either with the Bass,

or with the other two superior Parts, i. e. that one of the two superior Parts make a Third with the Bass, and the other a Fifth, or an Octave.

2. That sometimes the Sixth, accompanied with the Octave or Fourth, may be used instead of the Third, because then the two superior Parts make a Third among themselves.

3. That therefore the Fifth and Octave are very seldom to be used, because there will then be no Third to the Bass, or between the Parts.

4. That all Discords may be used in *Trios*, that the 9th must be accompanied with the 3d and 5th, as also very well with the 7th and redundant 5th, provided an Octave follow. The 2d must be accompanied with the 4th, and follow'd by the 3d. The 4th must be accompanied with the 5th or 6th, if it be syncoped, and followed by the 3d; or if it be not syncoped with the 2d, and followed by the 5th, either just or false, according to the Sequel of the Song and Harmony.

The *Tritone* must be accompanied with the Sixth or Second, and followed by the Sixth, but seldom by the Octave.

The false Fifth must be accompanied by the 3d or 6th, and followed by the Third.

The *superfluous Fifth* must be accompanied by the Third, &c.

The *seventh Major* or *Minor*, and syncoped must be accompanied with the 3d, or 5th, or 9th, but never or seldom by the Octave.

The *seventh Major*, may be accompanied by the Second or Fifth, and sometimes by a Fourth, if the Bass holds on a Note.

V.

V, is often found alone thus V, for one Violin; or thus V V, for two Violins.

VARIATIO, *Variatione*, signifies in Musick all the different Manners of playing or singing an Air, either in subdividing the Notes into others of less Value, or by adding of Graces, &c. in such a Manner however as one may still discern the Ground through all the Enrichments, which some call *embroideries*. Thus, for Instance, the different *Coplets* of the *Folies d'Espagne*, of *Chacones*, *Passecailles*, &c. and sometimes of *Gavots*, are so many Variations.

Uso, *Usage*, *Custom*, *Habitude*, or that frequent Repetition of the same Thing, in order to facilitate the Execution thereof; but in Musick that Word has a Signification something different, which is interesting enough to deserve the following ample Explication.

Therefore to understand well what *Uso* is in Musick, we must know that the *Melopœia* has three Parts, which the Greeks call *Lepsis*, *Mixis*, and *Chrestis*; and the Latins *Sumtio*, *Mistio*, *usus*; and the Italians, *Presca*, *Mescolamento*, and *Uso*.

The *Presca*, say *Aristides*, *Euclide*, *Martianus Capella*, &c. and after them *Bontempi*, teaches a Composer in what System he must place his Song; if he shall place it in the System of the grave Sounds, or of the acute or mean; and consequently in what Mode or Tone, and by what Note he must begin and end it.

Miscolamento, procures to the Composer the Means of mixing or joining the Sounds one after another, so that the Voice or Sound be always within a certain Compass, that the three Genera or Kinds of Modulation, viz. the *Diatonick*, *Chromatick*, and *Enharmonic*, may be conveniently disposed, and that the Song never move out of the System, that is, the Limit or Mode wherein 'tis begun, unless with some particular Design. *Mistio est per quam aut sonos inter se, aut vocis locos coagmentamus; aut modulationis genera, aut modorum systemata*, Arist. 'Tis properly no more than after having begun the Song, to pursue it without forcing any particular Sound therein, i. e. raising it too high, or falling too low, or using any forbidding Intervals, and well placing the natural, essential, necessary, or accidental Chords of the Mode, to go out of it and enter it again conveniently; in a Word, according to modern Expression, 'tis the Art of modulating well.

Lastly, the *Uso* is that Part of the *Melopœia*, which teaches the Composer how the Sounds are to follow one another, and in what *Situations* each of them ought and can be to form an agreeable Melody, or a good *Melodization*;

TABLATURA, signifies *Tallature*, which is in general, when to mark the Sounds, the Letters of the Alphabet, Cyphers, and other Signs are used, which is not common in the modern Musick; but this Term is more particularly adapted to the Manner of writing a Piece of *Musick* for the Theorbo, Lute, Guittar, Viol, or the like, which is done on parallel Lines (each of which represents a String of the Instruments) certain Letters of the Alphabet, whereof A marks that the String is to be struck open, *i. e.* without putting the Finger of the Left-Hand on the Neck. B shews that one of the Fingers is to be put on the first Stop, C on the second, D on the third, and so on through the Octave.

The *Tablature* of the *Lute*, is wrote in Letters of the Alphabet, and that of the Harpsichord in common Notes with Figures over their Heads, though the *Germans, Saxons, Swedes, &c.* who seldom or ever use our Notes, and who have rendered themselves famous for their accurate Practice and Knowledge of this Sort of Writing, use it, not only for the Lute, Bass-viol, &c. but also for the Organ and Harpsichord, placing plain Letters without Lines.

TEMPERAMENT, is what the *Italians* otherwise called *participatione*; wherefore they call the modern System, *Systema temperato*, or *participato*, because founded on Temperature, that is, on the Diminution of some Intervals, and the enlarging of others; which makes it participate of the *diatonick* and *chromatick* Systems.

The better to understand what is meant hereby, 'tis to be observed, 1. That among the Antients, there were three Sects, who had very different Opinions concerning the precise Compass or Extent of each Interval.

The first of these were the *Pythagoreans*, Disciples of *Pythagoras*, who would have it that Reason alone was the proper Judge of Sounds, and their Proportions, and consequently that the Forms of Intervals were all rational, *i. e.* they admitted none but such as they could demonstrate either arithmetically by Numbers, or geometrically by Lines; and that therefore, the fifth must always have the Proportion of 2 : 3, the fourth that of 3 : 4, the Tone minor, 9 : 10, the Tone major that of 8 : 9, exactly; and besides these they fix'd the Proportions of many other Intervals, which have afforded Disputes for as many Mathematicians.

But the Ear (the Judgment whereof is very nice) does not agree to what they so fixed. The rest in the Course of my Treatise.

TETRACHORD, in the antient *Musick*, a Concord consisting of three Degrees or Intervals, and four Terms or Sounds; called by the Antients also (more properly) *Diatessaron*, and by us a Fourth.

TRANSPOSITION, the writing any Song, Air, or Tune, in any Key different from that in which it was first composed.

Of these there are two Kinds; the first is with respect to the Cleff, and the second with regard to the Key.

Transposition with respect to the Cleff, consists in changing the Places or Seats of the Notes or Letters, among the Lines and Spaces; but so as that every Note be set at the same Letter.

This is done either by moving the same Cleff to another Line, or by using another Cleff; but with Signs that place the Tones and Semitones in the same Order as before, by reason the Piece is in the same Key.

The Practice is easy in the same Case; in the first you take the first Note at the same Distance above or below the Cleff-Note, in its new Position as before; and all the rest of the Notes in the same Relations or Distances from one another, so that the Notes are all set on Lines or Spaces of the same Name.

In the second, or setting the Musick in a different Key, 'tis to be observed, the Places of the three Cleff-Notes, are invariable in the Scale, and are to one another in their Relations, the mean a Fifth above the Bass, and the other a Fifth above the Mean.

Now to transpose to a new Cleff, for Example, from the Treble to the Mean, where if the new Cleff is set, we suppose that the individual Note on the same Place of the Staff, will be the same as that Part in the Composition, to which the new Cleff is originally appropriated, for instance may direct to the first Note we had before in the Treble. Now from the fixed Relations of the

three Cleffs in the Scale, it will be easy to find the Seat of the first transposed Note, and then all the rest are to be set at the same mutual Distances they were at before.

Suppose, for Example, the first Note of a Song to be D, a Sixth above the Bass Cleff, wherever that Cleff is placed, the first Note must be a greater Second above, because a greater Second above the Mean, is a Sixth above the Bass-Cleff, the Relation between the two being a Fifth; so the first Note will be still the same individual D.

The Use of this *Transposition* is, that if a Song being set with a certain Cleff in a certain Position, the Notes go far above or below the Staff of five Lines, they may by the Change of the same Cleff in the particular System, or by taking a new Cleff, be brought within the Compass of the Lines, or at least more within either Extreme than before.

Transposition from one Key to another, is a changing of the Key, or setting all the Notes of a Song at different Letters, and performing it consequently in different Places upon the Instruments. The Design thereof is, that a Song, which being begun in one Place is too high, too low, or otherwise inconvenient for a certain Instrument, may be begun in another Place, and from that carried on through all its just Degrees. The Cleff and its Position here remain the same, and the Change is of the Notes themselves from one Letter to another, and its Line or Space to another.

In the former *Transposition*, the Notes were expressed by the same Letters, but both removed to different Lines and Spaces; in this the Letters are unmoved, and the Notes of the Song transferred to, or expressed by other Letters, and consequently set on different Lines or Spaces, which therefore require a different Signature of the Cleff.

Transposition then, is the changing the Notes of a Song to a different Species of Octave, to that in which it was first composed, or at least in which 'tis actually noted, in such Sort that the Semitones of the two Fourths, which compose each Octave, as *mi fa*, and as the *French* have *si ut*, may be found by means of $\frac{1}{2}$ $\frac{1}{2}$ Flats, or \times \times exactly in the same Range, or in the same Degree or Proportion to another, as before *Transposition*, for Instance, *fig. 52.* where the Semitones of the Fourth in the *Diatonick* are found by means of Sharps.

Or 'tis the using one or more chromatick Chords, instead of the natural and diatonick, to constitute a Mode, that is to say, to place the Final on any Degree at Pleasure, or to render the Fifth above it just; and by that Means make it the Dominant, or to make the third Major or Minor, &c.

It must be observed, it is not impossible to transpose a diatonick Song, or one wherein there are none but natural Chords, either higher or lower, without the Aid of these chromatick Signs, either one Flat, or one Sharp, and very often one may not be sufficient; therefore we must remark that if many Flats or Sharps be found in a Song, either immediately after a Cleff, or in different Parts of the Song, on the natural or essential Chords of the Mode, it may be concluded, that the Song is in a transposed Mode, and therefore may be reduced to a natural one.

Lastly, *Transposition* is to use these chromatick Characters in such a Manner, as that by their Help the Chords of the two Octaves, though they begin and continue in different Letters or Degrees of the *Gamut*, may form the same Intervals, and consequently have the same Names. For Instance, *fig. 53.* here are only Examples of *ut* and *re*, because the Finals of all transposed Modes must be one of those two; if *ut*, the third above it is Major; if *re*, Minor.

Note, That the *Transposition* is a Thing which gives a great deal of Trouble to young Practitioners in singing. Sometimes by the Negligence either of Authors or Copists in forgetting to place the chromatick Sign, for a Flat or a Sharp being omitted after the Cleff, makes them mistake in transposing the Air, which they suppose noted in a certain Cleff, which the accidental Flats or Sharps in the Course of the Song shew not to be natural. This *Transposition* neither raises nor lowers the Tone, but changes the Notes

only, and reduces a transposed Song to a natural one.

TREMOLO, *Tremolante*, or *Tremante*, is often found either entire, or in abregée, *Trem.* To give Notice, especially to those who play on Instruments with a Bow, to make on the same Degree several Notes with a single Stroke of the Bow, to imitate as it were the Shake of the Organ. That's also often marked for Voices: We have Examples of both in Mr. Lully's Opera of *Isis*.

We find sometimes also, that Word *Tremolo*, and its diminutive *Tremoleto*, to signify what the French call, though improperly, *Cadence*, and which should be called *shake*.

TRIAS, a Term purely Latin, which signifies *three*, and in antient Musick a *Trio*, i. e. a Composition in three Parts, and to be performed by three Voices alone.

TRIAS HARMONICA, are Greek Terms latinized, which can be translated *Harmonick triad*; and is a Compound of three radical Sounds all heard together, neither of them being at the Octave of the two others; and of which one is a Fifth, and the other a Third above the other, which is the Fundamental.

The *Triad*, is properly a Consonance formed of a Third and a Fifth; which with the Bass or fundamental Sound make three different Terms; whence the Name *Triad*. That of harmonical is doubtless given it from the wonderful Property of the Fifth, which divides itself into two Thirds very naturally, both excellent and perfectly agreeable; so that this one Sound disposed between two others make two Thirds at once, one Major, the other Minor, and of Consequence a double Harmony.

Hence it is, that in *Trios*, particularly this Concord is preferred to that which divides the Octave into a Fifth and a Fourth, in regard that if there be Concord on one Side, there is a Discord on the other, whereas here the Harmony is compleat on both Sides. But here it must be observed, that the Fourth is by some accounted a Discord, but by most esteemed a Concord; and 'twas upon the Division, that a great many of the antient Niceties depended.

Of the three Sounds which compose the harmonical *Triad*, the gravest is called the Fundamental or Bass; the acutest, that is, that which makes the Fifth, and terminates the Concord upwards, is called the excluded or highest Sound, *sonus exclusus*, and that which divides the Fifth so agreeably into two Thirds, the harmonical Mean, *medius harmonicus*.

This Division of the Fifth into two Thirds may be performed two Ways, viz. *First*, harmonically, when the greater Third is lowest, and the less a-top, in which Case the *Triad* is said to be perfect and natural.

Secondly, arithmetically, when the less Third is lowest, and the greater a-top; in which Case the *Triad* is called imperfect or flat; both are good, but the last is not so much used as the first.

TRILLO, often marked, in Abregée, by a T. or by Tr. or only by a small t, as well for Voices as for Instruments; is to intimate, that you must beat very quick alternately, or one after another, two Sounds in conjoint Degrees, as *fa mi*, or *mi re*, &c. so that you begin by the highest, and end by the lowest; and this is properly the *Cadence* or *Shake*, in the French Manner. But it is also very often a Mark, especially in the Italian Musick, that you must be at the same Note several Times on the same Degree, beginning a little slow, and ending with all the Quickness the Throat can form them: For Instance, fig. 56.

Therefore this is properly the true Italian Trillo, at least as it can be expressed by common Notes. The Italians use it more particularly after they have held out a Note, or made a *Roulade* or *Tirata* of two or more Measures to ease the Voice, which so long a Tension had weakened.

TRIO, is said of a Piece of Musick made to be performed by three Voices, or of all Composition in three different Parts. But in this Composition which is the best, and which ought to be the most regular of all; we must observe, 1. That besides the general Rules of the Counterpoint, which forbid making two Octaves or two Fifths to follow one another, either to the Bass or among the other Parts, in *Trios*, the Third must be heard in every Time of the Bar, either with the Bass,

or with the other two superior Parts, i. e. that one of the two superior Parts make a Third with the Bass, and the other a Fifth, or an Octave.

2. That sometimes the Sixth, accompanied with the Octave or Fourth, may be used instead of the Third, because then the two superior Parts make a Third among themselves.

3. That therefore the Fifth and Octave are very seldom to be used, because there will then be no Third to the Bass, or between the Parts.

4. That all Discords may be used in *Trios*, that the 9th must be accompanied with the 3d and 5th, as also very well with the 7th and redundant 5th, provided an Octave follow. The 2d must be accompanied with the 4th, and follow'd by the 3d. The 4th must be accompanied with the 5th or 6th, if it be syncoped, and followed by the 3d; or if it be not syncoped with the 2d, and followed by the 5th, either just or false, according to the Sequel of the Song and Harmony.

The *Tritone* must be accompanied with the Sixth or Second, and followed by the Sixth, but seldom by the Octave.

The false *Fifth* must be accompanied by the 3d or 6th, and followed by the Third.

The *superfluous Fifth* must be accompanied by the Third, &c.

The *seventh Major* or *Minor*, and syncoped must be accompanied with the 3d, or 5th, or 9th, but never or seldom by the Octave.

The *seventh Major*, may be accompanied by the Second or Fifth, and sometimes by a Fourth, if the Bass holds on a Note.

V.

V, is often found alone thus V, for one Violin; or thus V V, for two Violins.

VARIATIO, *Variatione*, signifies in Musick all the different Manners of playing or singing an Air, either in subdividing the Notes into others of less Value, or by adding of Graces, &c. in such a Manner however as one may still discern the Ground through all the Enrichments, which some call *embroideries*. Thus, for Instance, the different *Coplets* of the *Folies d'Espagne*, of *Chacones*, *Passecailles*, &c. and sometimes of *Gavots*, are so many Variations.

Uso, *Usage*, *Custom*, *Habitude*, or that frequent Repetition of the same Thing, in order to facilitate the Execution thereof; but in Musick that Word has a Signification something different, which is interesting enough to deserve the following ample Explication.

Therefore to understand well what *Uso* is in Musick, we must know that the *Melopœia* has three Parts, which the Greeks call *Lepsis*, *Mixis*, and *Chraxis*; and the Latins *Suntio*, *Mistio*, *usus*; and the Italians, *Presca*, *Mescolamento*, and *Uso*.

The *Presca*, say *Aristides*, *Euclide*, *Martianus Capella*, &c. and after them *Bontempi*, teaches a Composer in what System he must place his Song; if he shall place it in the System of the *grave Sounds*, or of the acute or mean; and consequently in what Mode or Tone, and by what Note he must begin and end it.

Mescolamento, procures to the Composer the Means of mixing or joining the Sounds one after another, so that the Voice or Sound be always within a certain Compass, that the three Genera or Kinds of Modulation, viz. the *Diatonick*, *Chromatick*, and *Enharmonic*, may be conveniently disposed, and that the Song never move out of the System, that is, the Limit or Mode wherein 'tis begun, unless with some particular Design. *Mistio est per quam aut sonos inter se, aut vocis locos coagmentamus; aut modulationis genera, aut modorum systemata*, Arist. 'Tis properly no more than after having begun the Song, to pursue it without forcing any particular Sound therein, i. e. raising it too high, or falling too low, or using any forbidding Intervals, and well placing the natural, essential, necessary, or accidental Chords of the Mode, to go out of it and enter it again conveniently; in a Word, according to modern Expression, 'tis the Art of modulating well.

Lastly, the *Uso* is that Part of the *Melopœia*, which teaches the Composer how the Sounds are to follow one another, and in what *Situations* each of them ought and can be to form an agreeable Melody, or a good *Melodization*;

ation; which according to *Aristides* can be done in three Manners, to which *Euclid* has added a fourth, of which I'll speak afterwards.

The first is called by the *Greeks* *Agoge*, or *Agogi*, by the *Latins* *Ductus*, and *Conducimento* by the *Italians*, and is when the Sounds follow one another *di grado*, or in conjoint Degrees, *i. e.* from one to another without missing an intermediate Degree.

Of *Ductus* there are three Kinds, the first is *Ductus rectus*, or *Conducimento retto*, when the Notes or Sounds follow one another immediately rising, as fig. 59. which the *Italians* call also *di grado ascendente*.

The second is *Ductus revertens*, or *Conducimento ritor-nante*, and is when the Sounds follow one another immediately descending, as fig. 60. which is likewise called by the *Italians* *di grado descendente*.

The third is *Ductus circumcurrents*, or *Conducimento circumcurrente*, which is that after having ascended by natural or diatonick Chords, they descend by the same Degrees, except instead of *b* natural, *b mol* or flat is touched in this Descent; or when the Ascent is by *b* natural, and the Descent by *b mol*, as fig. 61. or on the contrary, when you ascend by *b mol*, to descend immediately by *b quarre*.

The second Kind of the *Uso*, is that called *Ploke*, or *Ploki*, by the *Greeks* *Nexus*; *Implicatio*, *Textura*, &c. by the *Latins*; and by the *Italians* *Nesso*; which is when passing from one Sound to another; either in ascending or descending; we do not take that which follows immediately, but one or two, or more; which is clearly demonstrated, fig. 62. this the *Italians* call *di salto*; and the *French* to proceed by disjoint Degrees.

Lastly, the third Sort of *Uso*, is that called by the *Greeks* *Petteia*, and by the *Latins* and *Italians* *Pettia*. Which to understand well, we must observe, 1. That Sounds in general, have the Faculty to express by themselves, and even excite in Men, what the *Latins* call *Mores*, and the *Italians* *Custom*, *i. e.* certain inward Motions, called by the Philosophers, Affections or Passions. The Sound of Drums and Trumpets is a sensible Proof thereof, and almost a continual one among Soldiers.

2. That among Sounds some are naturally more proper, to express or excite certain Passions than others which produce other Effects. Thus acute Sounds excite Mirth, Gaiety, Courage, &c. whereas grave Sounds, have something dull and melancholick. Likewise Songs which proceed by diatonick Chords, have something merry, &c. and those which proceed by *b mol* are tender, soft, affectuous, &c.

3. The different Combination of Sounds one with another, or those Passages made alternately from the acute to the grave, or from the grave to the acute; whether made by conjoint Degrees, as in the *Conduciments*, or by disjoint ones, as in the *Nesso*, have no less Force to express or excite the Passions. Thus, for Example, the *Nesso*, or *Saltum*, from the third Minor in ascending, can excite Tendernefs, Pity, a soft and agreeable Melancholy, &c. whereas it excites Mirth, Joy, &c. in descending.

4. Lastly, it is certain, that a frequent Repetition of the same Sound; that that Repetition made very quick, or very slow; that an interrupted Continuation of the same Sound, during a considerable Time, &c. produce sensibly very different Effects.

Therefore it is the *Pettia*, says *Aristides*, which procures us the Means, and gives us the surest Rules to make a just Discernment of those, or ordering or combining Sounds between themselves; to place them as they should be, and in a Manner that they may produce their Effect, *i. e.* to express the different Passions which one wants to excite, which consequently lets us know what Sounds we are to employ in our Songs, and which we are to exclude from them; if it be proper, and how often we are to repeat them; if we must begin (especially in the *Nesso*) by an acute Sound, to descend to a grave one; or, on the contrary, ascend from a grave Sound to an acute.

Euclid gives an Explication something different of all these different Parts of the *Melopodia*; for, after he has established that the *Melopodia*, is the art of reducing the Harmony into Practice; he adds, that it is done in four

Manners, the two first of which, *viz.* *Dactus* and *Nexus*, are the same above explain'd. But he pretends, 1. That the *Pettia*, which he considers as the 3d Manner, is nothing else but a Repetition of the same Song on the same Degree, which is very true, though he is too concise on that Subject.

2. That besides those three Manners, there is a fourth, called in the *Greek*, *Tone* or *Toni*, in *Latin* *Extensio*, and in *Italian* *Dissentimento*; and is when one dwells a long while, and without Interruption on the same Song.

True it is, that among what we have of the Antients here, are a great many excellent Rules for properly ranging Sounds one after another, so as to make Melody; and so that by such Progression, all our different Passions may be moved, but we do not find a Word concerning the properly disposing Sounds one above another, *i. e.* so as to form an Agreement or Union between them, called Concord, or a Disagreement called Discord, and Contrast between those two, which when heard together, make what we call Harmony. Now what strong and noble Expressions do we not meet with in those Pieces, called Conforts, arising from the agreeable Mixture of Conforts and Discords.

We find that the Antients had certain Signs to shew when a Sound was to be held longer or shorter; but the Adherents to the antient Practice, will find some Difficulty to prove that their Measure was so just and regular as ours, by which our Composers are furnished with that great Variety of strong and lively Expressions; and as they practised not Harmony or Time as we do, it necessarily follows, that their *Musick* was not near so perfect as that of the Moderns.

W.

WIND-INSTRUMENTS. — The Wind-Instruments of the Antients, were the *Tibia*, *Fistula*, *Syringa* or *Pan*, consisting of seven Reeds joined side-wise, also *Orgon*, *Tuba* or *Trumpet*, *Cornua*, *Lituus*, &c.

X.

X signifies properly no more than *Decima* or ten, as *Opera*, *X^a*, &c.

Y.

Y. This Letter is of no Use in the *Italian* Tongue, because instead thereof the *Italians* use always the Vowel I.

Z.

Z. This Letter is pronounced in the *Italian* before all the Vowels, as if there was a *D*, thus we must pronounce *DZeffiro* a little hard, instead of *Zeffiro*.

ZAMPOGNA, which is also wrote *Sampogna*, which signifies in *Latin* *Fistula*, is in general all Instruments which have the Sound of a Flute, and in particular of Bag-Pipe, composed of several Flutes, and often of a common Flute, &c.

ZORRO, in *Latin* *Claudus*, lame, decrepid, hopping; 'tis from hence that they call one of the oblique Counter-Points, *Contra punto à la Zoppa*, a lame Counter-Point; because one is obliged to place in each Bar, to the Subject given, one Note between two others, that is as long as them both, which, when it comes to be played or sung, by the frequent Syncopes, to proceed by a Leap, or in a jumping Manner; as is plainly seen, fig. 63.

ZUFFOLO, or ZUFOLO, or *Suffolo*, signifies properly, in *Latin* *Sibilus*, in *French* *Settlement*, and in *English* *Whistling*; hence a certain small Flute, which has the Sound so acute, that it imitates the Whistling of Birds, called in *French* *Flageolet*; usually made of Box or other hard Wood, sometimes of Ivory; it has six Holes, besides that at the Bottom, the Mouth-Piece, and that behind the Neck. — The *Pife*, is also a Kind of *Leggiero* Note, That as *Opera's* have been of late Years very much in Vogue in *England*, where the *Italian* Singers have found the Secret, not of the Transmutation of Metals, but of changing their Throats into a *Cornucopia*; and where despicable Humbugs have been more generously rewarded (if we are not ashamed to call a Generosity, which should be more properly called a scandalous Prodigality) for disfiguring what Melody has the most agreeable, by unnatural squeals, capable to tear the Ear of those who are not accustomed

with what deviates more from Nature, than a gallant Soldier, who has weather'd in the Service of his Country, and carries on his Body, in a hundred Cicatrices, the glorious Marks of his Courage; or any other, who has procured some signal Advantages to the Republick; and who, but too often, are left to starve in the Dust of a despicable Garret; I'll conclude this Treatise by a short Differtation on Opera's and Singing, from M. St. Evremont.

That Author begins by confessing ingenuously, that he does not love Comedies in *Musick*, i. e. Opera's; though he confesses, likewise, at the same Time, that their Magnificence please him well enough, that their Machines have something surprizing; their Musick have, in some Places, something moving, and that the whole together, or *tout en semble*, is, in some Measure marvelous; but that those Charms become soon tedious; for where the Mind has so little to do, the Senses must necessarily grow tired. After the first Pleasure the Surprise gives us, the Eyes are employed, and grow weary afterwards of a continual Application to the Objects. At the Beginning of the Concerts, the Justness of the Accords is taken Notice of; nothing escapes of all the Diversities united together, to form the Sweetness of the Harmony: Some Time afterwards the Noise of the Instruments stuns us; the Musick is no more any Thing else but a confused Noise to the Ears. But who can conquer the tedious Prolixity of the Recitative in a Modulation, which has neither the Charm of the Song, nor the agreeable Strength of the Word? The Soul fatigued with a long Attention, where she discovers nothing which can agreeably entertain her Faculties, searches within herself some secret Motion, which can affect her; and the Mind which has lent itself in vain to outward Impressions, abandons itself insensibly to a Kind of indolent Thoughts, or becomes disagreeable to itself in its Inaction. At last one becomes so extremely tired, that he longs to be out; and the sole Pleasure left to the indolent Spectators, is the Hope of seeing soon the End of the Spectacle.

M. de St. Evremont says, that all the Opera's he had seen, appeared always to him despicable in the Disposition of the Subject, and in the Poetry. Therefore it is in vain, that the Ear is flatter'd, and Eyes charmed, if the Mind is not pleased. My Soul in Intelligence with my Mind, more than with my Senses, forms a secret Resistance to the Impressions she can receive, or at least refuses giving them an agreeable Consent, without which the most voluptuous Objects cannot give a great Pleasure. A Folly loaded with Musick, Dances, Machines, and Decorations, is a magnificent Folly, but is still always a Folly; it is an ugly Foundation under fine Outfides, where I penetrate with much Disgust.

There is another Thing in Opera's so much against Nature, that it is impossible it should not shock a sound Imagination, and that is, to have the whole Piece sung from the Beginning to the End; as if the Persons who are represented, had dressed themselves in a ridiculous Manner, to treat in Musick the most common and most important Affairs of their Life. Can we imagine, that a Master calls his Servant, and commands him something in Singing? That a Friend intrusts his Friend with his Secret in Singing; that the Privy-Counsellors or Ministers of a Prince form their Deliberations in Musick; and that Men are killed melodiously in a Battle? In acting thus it is to lose the Spirit of the Representation, which without doubt is preferable to that of the Harmony; since the Harmony should be nothing else but a simple Accompaniment, which has been added by the greatest Masters of the Theatre, as something agreeable, but not necessary, after they have regulated all that regards the Subject and the Discourse. Notwithstanding which the Idea of the Musician goes before that of the Heroes, in Opera's. It is *Lully*, *Handell*, &c. who present themselves to the Imagination. The Mind which cannot conceive Hero's that sing, minds the Composer of the Piece; and it cannot be denied that in the Representations of the Palace Royal at *Paris*, and in those of the *Hay-Market* in *London*, *Lully* and *Handell* are much more minded than the Heroes of the Piece.

Notwithstanding which, I do not pretend to exclude all Sorts of Songs from the Theatre; there are Things which must be sung, and others which can be sung without shocking Decency and Reason; as Vows, Prayers, Sacrifices, and all that regards the Service of the Gods, has been sung among all Nations, and in all Ages. Tender and sorrowful Passions, are expressed naturally by a Sort of Song; the Expressions of Love in its Beginnings; the Irresolution of a Mind agitated by different Movements, are a Matter proper for Stanzas, and Stanzas a proper Matter for Musick. Almost every Body knows that Chorus's had been introduced on the Theatre of the *Greeks*, and have been introduced since on ours, where they produce a very good Effect. We have some Opera's of *Lully's*, in this last delicate Taste, particularly that of *Atis*, which I hear always with a great deal of Pleasure, when in *France*; and which will have always the Charms of the Novelty on the Theatre. There's scarce any Thing in that Opera which cannot be sung; or to speak better, all that's in it would have no Charms if it was not sung; since there is nothing in that Opera but Love Intrigues, Disappointments in Love, and the most natural Expressions of the different Motions which torture the Soul of a powerful, and most implacable Rival, who takes Pleasure in persecuting two tender, sincere, and innocent Lovers *Atis* and *Sangaride*. I used to be almost extasied when I heard the *Pelissiere*, inviting *Cybele* to come down from Heaven: And nothing displeases me in the Spectacle but the Representation of the bad Dreams of *Atis*. But the Opera of *Roland*, though the Musick be as excellent as that of *Atis*, has a quite different Effect on my Mind. For all that is of a Conversation or Conference; all that regards Intrigues and Affairs, all that belongs to Council and Action, is proper for Comedians, who recite; and ridiculous in the Mouth of Musicians that sing. The *Greeks* used to make beautiful Tragedies where they sung something; and the *Italians* and *French*, and sometimes the *English* make very bad ones, where they sing every Thing.

Therefore an Opera, according to M. de St. Evremont, is a whimsical Work of Poetry and Musick, where the Poet and the Musician, equally distressed by one another, take much Trouble to make a bad Piece. Not but very agreeable Words and beautiful Airs may be found in it; but one may be sure to be disgusted at last, by the Poetry, where the Genius of the Poet has been confined within too narrow Limits; and the Tedioufness of the Song, where the Musician has exhausted himself in a too long Musick.

The *Italians* despise the *French* Opera's, and the *French* have no Taste for the *Italian*. The *Italians* who mind nothing else but the Representation, cannot suffer we should call Opera a Texture of Dances and Musick, which have not a very just Report, and a very natural Connexion with the Subjects. The *French* used to the Beauty of their Overtures, to the Agreement of their Airs, to the Charm of their Symphonies, suffer with Pain the Ignorance or bad Use of the Instruments in the Opera's of *Venice*, and refuse their Attention to their long Recitative, which becomes tedious by the little Variety found in it. — Thus far of the different Constitutions of the Opera.

As to the Manner of Singing, called in *France* Execution, M. de St. Evremont believes, that no Nation in the World can dispute it with the *French*. The *Spaniards* have a marvellous Disposition of Throat, but with their Trillings and Quaverings, they seem as if they had no other Intention in their Song, than to dispute the Facility of the Throat with the Nightingales. The *Italians* have the Expression false, or at least forced, by not knowing justly the Nature or Degree of the Passions: It is to burst out in laughing, rather than to sing, when they express some Sentiment of Joy; if they want to sigh, one hears Groans forming in their Throat with Violence, and not Sighs which escape secretly from the Passion of a Heart in Love; they make of a sorrowful Expression, the most violent Exclamations; Tears shed for an Absence, are Tears fit to accompany a Funeral; the melancholick becomes mournful in their Mouth; they rave instead of complaining in their Anguish; and sometimes they express the Anguish of their Passion as a fainting Fit.

The same Author adds, that he has seen Comedies in *England* where there was a great deal of *Musick*, but that to speak discreetly of them, he could never accustom himself to the Manner of singing of the *Englisch*, that he came too late in their Country to take a Taste so different from all others. That there is no Nation which shews more Courage in Men, and more Beauty in Women, and more Wit in the one and the other Sex. But that it is impossible a Nation should have all Perfections; and that where all good Qualities are common, it is not so great an Evil, that the good Taste should be scarce; and that it is certain it is seldom found in *England*; but that the *Englisch* among whom it is found, have it as nice and delicate as any other Person in the World. For my Part I am of Opinion, that if M. *St. Evremont* had lived till our Days he had changed Sentiments; for I perceive that the *Englisch* in general have as good a Taste for *Musick* as any other Nation, and sing with a certain Agreement, which flatters as agreeably my Ear, though a *French* one, as the finest *Airs* of *Lully*, in the Mouth of the best *French* Singer; but for the *Italian* Singing, though I have assisted at the Opera's of *Venice*, *Bologna*, *Rome*, &c. I confess ingeniously that I could never accustom myself to it.

M. *de St. Evremont* concludes, that *Salus gallus cantat*, i. e. that none but the *French* sings: He confesses that there are few People who have the Comprehension slower than the *French*, either for the Sense of the Words, or to understand what the Composer means, that there are few who understand less the Quantity, and find with more Difficulty the Pronunciation; but that after an assiduous Study has made them conquer all those Difficulties, and they happen to be entire Masters of what they sing, nothing comes near their Charms. The same may be said of them with regard to the Instruments, where nothing is either sure or very just, but after a great Number of Repetitions; but nothing cleaner or more polite when the Repetitions are ended. The *Italians* profound in *Musick* carry their Science to the Ears without any Softness; the *French* are not contented with freeing the Science of its first Harshness, which smells of the Labour of the Composition, but find likewise, in the Secret of the Execution, a certain Charm for the Soul, and something so moving that it penetrates the inmost Recesses of the Heart.

Musick has ever been in the highest Esteem in all Ages, and among all People; nor could Authors express the Opinion of it strongly enough, but by inculcating, that it was used in Heaven, and was one of the principal Entertainments of the Gods, and the Souls of the Blessed.

The Effects ascribed to it by the Antients are almost miraculous; by means hereof Diseases are said to have been cured, Unchastity corrected, Seditions quelled, Passions raised and calmed, and even Madness occasioned. *Athenicus* assures us, that antiently all Laws, divine and civil, Exhortations to Virtue, the Knowledge of divine and human Things, Lives and Actions of illustrious Men were written in Verse, and publicly sung by a Chorus to the Sound of Instruments, which was found the most effectual Means to impress Morality, and a right Sense of Duty on the Mind.

Musick made a great Part of the Discipline of the antient *Pythagoreans*, and was used by them to draw over the Mind to laudable Actions, and settle in it a passionate Love of Virtue: It was their Doctrine, that the Soul itself consists of Harmony, and therefore by *Musick* they pretend to revive the primitive Harmony, of our Faculties. By this primitive Harmony they mean that which, according to their Dogma, was in the Soul, in its pre-existent State in Heaven.

Dr. *Wallis* has endeavoured to account for the surprising Effects ascribed to the antient *Musick*, and changes them principally on the Novelty of the Art, and the Hypnoticks of the antient Writers; nor does he doubt but the modern *Musick*, *ceteris paribus*, would produce Effects at least as considerable as the antient. The Truth is, we can match most of the antient Stories of this Kind in the modern Histories. If *Timotheus* could excite *Alexander's* Fury with the *Phrygian* Mode, and root him into Indolence with the *Lydian*; a more modern Musician is said to have driven *Erick King* of

Denmark into such a Rage as to kill *Ulrich* a Servant. Dr. *Niccolini* tells us of an *Italian*, who by varying his *Musick* from brisk to solemn, and so vice versa, could move the Soul so as to cause Distraction and Madness. And Dr. *South* has founded his Poem, called *Musica Incantans*, on an Instance he knew of the same Thing.

Musick however, is not only found to exert its Force on the Affections, but on the Parts of the Body also; witness the *Gafcon* Knight, mentioned by Mr. *Boyle*, who could not contain his Water at the playing of a Bag-pipe; the Woman mentioned by the same Author, who would burst out in Tears at the playing of a certain Tune, with which other People were but little affected. To say nothing of the true Story of the Tarentula; we have an Instance in the History of the Academy of Sciences, of a Musician being cured of a violent Fever by a little Concert occasionally played in his Room.

Nor are our Minds and Bodies alone affected with Sounds, but even inanimate Bodies. *Kircher* tells us of a large Stone that would tremble at the Sound of one particular Organ-pipe; and *Morhoff* mentions one *Petter* a *Dutchman*, who could break Rummer-Glasses with the Tone of his Voice. *Merfenne* also tells us of a particular Part of a Pavement that would shake and tremble, as if the Earth would open, when the Organs played. Mr. *Boyle* adds, that Seats will tremble at the Sound of the Organs; that he has felt his Hat do so under his Hand at certain Notes, both of Organs and Discourse; and that he was well informed, every well-built Vault would answer some determinate Note.

There is a great Dispute among the Learned, whether the Antients or Moderns best understood, and practised *Musick*? Some maintain that the antient Art of *Musick*, by which such wonderful Effects were performed is quite lost; and others, that the true Science of Harmony is now arrived to much greater Perfection, than was known or practised among the Antients.

This Point seems no other Way determinable, but by comparing the Principles and Practice of one with those of the other. As to the Theory and Principles of Harmonies, it is certain we understand it better than the Antients, because we know all that they knew, and have improved considerably on their Foundations. The great Dispute then lies on the Practice; with regard to which it may be observed, that among the Antients, *Musick*, in the most limited Sense of the Word, included *Harmony*, *Rithmus*, and *Verse*; and consisted in Verses sung by one or more Voices alternately or in Choirs, sometimes with the Sound of Instruments, and sometimes by Voices only. Their musical Faculties, we have already observed, were *Melopœia*, *Rhythmopœia*, and *Pœsis*. The first whereof may be considered under two Heads, viz. *Melody* and *Symphony*. As to the latter, it seems to contain nothing but what relates to the Conduct of a single Voice, or making what we call *Melody*; the Antients do not appear to have ever thought of a Concert, or Harmony in Parts; which is the modern Invention, for which, as already mentioned, we are beholden to *Guido Arctin*.

We would not however be understood to mean that the Antients never joined more Voices or Instruments than one together in the same Symphony; but that they never joined several Voices so as that each had a distinct and proper Melody, which made among them a Succession of various Concords, and were not in every Note Unions, or at the same Distance from each other as Octaves. This last indeed agrees to the general Definition of the Word *Symphony*, yet it is plain that in such Cases there is but one Song, and all the Voices perform the same individual Melody. But when the Parts differ, not by the Tension of the whole, but by the different Relations of the successive Notes, this is the modern Art, which requires so peculiar a Genius, and on which Account the modern *Musick* seems to have much the Advantage of the antient.

The most antient Writer of *Musick* was *Isidore* *Maronensis*, but his Works as well as those of many others both *Greek* and *Roman* are lost. *Aristoxenus*, Disciple of *Aristotle*, is the eldest Author extant on the Subject; after him came *Euclid*, Author of the Elements, in

Quintilianus wrote after *Cicero's* Time. *Alypius* stands next, after him *Gaudentius* the Philosopher, and *Nicomachus* the Pythagorean, and *Bacchius*. Of which seven Greek Authors we have a fair Copy with a Translation and Notes by *Melibanus*.

Ptolemy, the celebrated Mathematician, wrote in Greek of the Principles of Harmonics about the Time of the Emperor *Antoninus Pius*. This Author keeps a Medium between the Pythagoreans and Aristoxenians; he was succeeded at a good Distance by *Manuel Bryennius*.

Of the Latins we have *Boethius*, who wrote in the Time of *Theoderick the Goth*, and one *Cassiodorus*, about the same Time; *Martianus* and *St. Augustin*, not far remote.

Of the Moderns, are *Zarlin*, *Salinas*, *Vincenzo Galileo*, *Doni*, *Kircher*, *Mersenne*, *Brossard*, *Paran*, *De Caux*, *Perrault*, *Wallis*, *Des Cartes*, *Holder*, *Malcolm*, &c.

Some of the most famous Masters of Musick we have at present in England, are the Drs. *Green*, *Pepusch*, *Gailliard*, *Mess. Handel*, *Lampe*, &c.

MYTHOLOGY.

MYTHOLOGY, ΜΥΘΟΛΟΓΙΑ, (from *μῦθος*, *fabula*; and *λογος*, *sermo*, *Discourse*) is the History of the fabulous Gods, and Heroes of Antiquity; with the Explication of the Mysteries, or Allegories, couched therein.

The innate Idea Man has of a supreme Being, the beautiful Symmetry subsisting between the different Parts which compose this vast Universe, without the least Disorder or Confusion; the regular Revolution of the Seasons, so well calculated for the Preservation of every Individual; and which from the very first Instant of his Creation has much contributed towards strengthening that Idea, have engaged him to search that supreme Being (the infinite Notion whereof he soon found above his natural Apprehension, and which he could acquire but by reasonable Conjectures, and necessary Consequences) where he thought he was more likely to find him; whence he has often mistook for his Creator the Creatures themselves.

It is true, if we believe *Moses*, that the first Man had that Idea with which he had been created, strengthened, or rather supported, by the frequent Visits of his divine Creator, while he continued in his State of Innocency; and though the divine Knowledge of that supreme Being, such as he is, surpassed still his Apprehension, though irradiated by that divine Light, which suffered so total an Eclipse by his Prevarication and Ingratitude, that it could never since that fatal Epocha dissipate entirely the dark Cloud it was then covered with, he knew notwithstanding his divine Existence, where, and in what Manner he existed, without being puzzled to search him any where else but where he was. But as that perfect Knowledge of the supreme Being was inseparable from that State of Innocency, it vanished with it; and God irritated at *Adam's* Ingratitude, punished it with a still greater Severity in his Descendants, than he had done in the Prevaricator himself, by abandoning them to the Extravagance of their Imagination, and suffering that they should search him where he was not. It may be reasonably supposed that *Adam*, notwithstanding the Weakness of his Understanding, and the Depravation of his Heart, continued still in the Worship of the true God, and maintained his own Children in it while he lived; but as his Posterity had not the same undeniable Proofs of the true God, himself had, that he was no more to give them the necessary Lessons on that important Subject; that most of those who had learned them from him, had either forgot, or neglected them; and the few who had retained them, had not Authority enough to keep the rest in their Duty to the Almighty. For Men following then but the Dictates of a vitiated Reason, and entirely buried in the Senses, could not, or rather would not be persuaded of that Invisibleness, Immensity, Infinity, &c. which are some of the essential Attributes of the true God. They had heard by Tradition, that the same Creator who had formed *Adam* of nothing, used to descend in the Garden to converse with him, which they thought he could not do without being something corporal; and therefore that the Sentiments of his Invisibleness others endeavoured to inspire them with, were either Romances or Impostures, which revolted their Reason; which Reason could find among the Things visible, all the Perfection which they attributed to a Thing invisible, and could make on their Mind the same Impressions of Awfulness, Respect, and Reverence,

persuading themselves that they were as much obliged to consult their Understanding and Senses, in Things which related to the Worship of a Divinity, as in all the other Actions of their Life, since both were given them for Rules of their Conduct.

Therefore, I imagine that the first false Divinity adored when they began to abandon the Worship of the true God, was the Sun, since that Planet has something capable to affect our Senses in the most sensible Manner, and keeps our Understandings in Suspence, as if it could claim a human Respect. Nature besides seeming to depend entirely for its Preservation, on its periodical Course and Influences, could very well entertain them in that erroneous Belief, that the World had been created by it.

Men, in all Appearance, continued in that Worship of the Sun, and perhaps of the other Planets, according as their ridiculous Fancy led them, till having darkened quite, by the Depravation of their Manners, the innate Idea they had of a true God, and made an entire Divorce with their Reason, they crowded Heaven and Earth with as many Divinities as they could imagine. The Earth itself was deified for furnishing Fruits necessary for their Subsistence of Men and Animals; then Fire and Water became Objects of divine Worship for their Usefulness to human Life.

When Things were thus got in the Train, Gods by Degrees became multiplied to Infinity, and scarce any Thing but what the Weakness or Caprice of some Devotee or other, elevated into that Rank, Things useless, or destructive not excepted.

To authorize their own Crimes, and justify their Vices and Debaucheries, Men constituted criminal, vitious, and licentious Gods, unjust, rapacious, and tyrannical Gods, covetous and thievish Gods, drunken Gods, impudent Gods, cruel and bloody Gods.

The Principal of the ancient Gods, whom the Romans called *Dei majorum gentium*, and which *Cicero* calls *Celestial Gods*, *Varro*, select Gods, *Ovid*, *nobiles Deos*, others *consentes Deos*; were *Jupiter*, *Juno*, *Vesta*, *Minerva*, *Ceres*, *Diana*, *Venus*, *Mars*, *Mercury*, *Neptune*, *Vulcan*, *Apollo*.

Jupiter, was considered as God of Heaven, *Neptune*, as God of the Sea; *Mars*, as God of the War; *Apollo*, of Eloquence, Poetry, and Physick; *Mercury*, of Thieves; *Bacchus*, of Wine; *Cupid*, of Love. *Juno* was the Goddess of the Air; *Diana*, the Goddess of Woods and Chastity; *Proserpina*, the Goddess of Hell; *Venus*, of Beauty; *Thetis*, of the Sea, &c.

A second Sort of Gods, called *Semi-Gods*, *Semi-dii*, *Dii minorum gentium*, *Indigetes*, or Gods adopted, were Men canonized and deified. As the greater Gods had Possession of Heaven by their own Right, these secondary Deities had it by Right of Donation, being translated into Heaven for that they had lived as Gods upon Earth.

The Heathen Gods may all be reduced to the following Classes, 1. Created Spirits, Angels, or Demons; whence good and evil Gods, *Genii*, *Lares*, *Lamures*, *Guardian Gods*, *infernal Gods*, &c.

Genii, was supposed by the Heathens a good or evil Spirit or Demon, set over each Person to direct his Birth, accompany him in Life, and to be his Guard.

Among the Romans, *Festus* observes, the Name *Genius* was given to the God who had Power to do

all Things; *Deum quicquid contineret rerum omnium gerendarum*; which *Vossius, de Idolol.* rather chuses to read *gignendarum*, who has the Power of producing all Things; by *Reatin. Censorinus* frequently uses *gerere* for *gignere*.

Accordingly *St. Augustin, De civitat. Dei*, relates from *Varro*, that the Genius was a God who had the Power of generating all Things; and presided over them when produced.

Pestus adds, that *Aufustius* spake of the Genius as the Son of *Cael*, and the Father of Men who gave them Life; others, however, represented the Genius as the presiding or tutelary God of each Place: And it is certain that last is the most usual Meaning of the Word.

The Ancients had their Genii of Nations, of Cities, of Provinces, &c. Nothing is more common than this following Inscription on Medals, GENIUS POPULI ROMANI. *The Genius of the Roman People*; or GENIO POP. ROM. *To the Genius of the Roman People*.

In the same *Genius* and *Lar* were the same Thing; as in *Plut. Censorinus* and *Apuleius* affirm they were.

The *Platonists* and *Eastern Philosophers*, supposed the Genii to inhabit the vast Region or Extent of Air between Earth and Heaven. They were a Sort of intermediate Powers, who did the Office of Mediators between the Gods and Men. They were the Interpreters and Agents of the Gods; communicated the Wills of the Deities to Men; and the Prayers and Vows of Men to the Gods: As it was unbecoming the Majesty of the Gods to enter into such trifling Concerns; this became the Lot of the Genii, whose Virtue was a Mean between the two; who derived Immortality from the one, and Passions from the other, and who has a Body framed of an aërial Matter. Most of the Philosophers held, that the Genii of particular Men were born with them, and died; that *Plutarch* attributes the ceasing of the Oracles to the Death of the Genii.

The Heathens, who consider'd the Genii as the Guardian Spirits of particular Persons, believed that they rejoiced, and were afflicted at all the good and all Fortune that befel their Wards. They never, or very rarely appeared to them; and then only in Favour of some Person of extraordinary Virtue or Dignity. They likewise held a great Difference between the Genii of different Men, and that some were much more powerful than others; on which Principle it was, that a Wizard in *Appian*, bid *Anthony* keep at a Distance from *Ottavus*, by Reason *Anthony's* Genius was inferior to, and stood in Awe of that of *Ottavus*.

There were also evil Genii, who took a Pleasure in persecuting Men, and bringing them evil Tidings: Such was that in *Paterculus*, &c. which appeared to *Brutus* the Night before the Battle of *Philippi*. These were also called *Lares* and *Lemures*.

Lares, were a Kind of domestick Genii, or Divinities, worshipp'd in Houses, and esteem'd the Guardians and Protectors of Families; supposed to reside more immediately in the Chimney Corner.

Plutarch distinguished good and evil *Lares*, as he had before done good and evil Genii.

There were also some publick, others private *Lares*.

Apuleius tells us, the domestick *Lares*, were no more than the Souls of departed Persons, who had lived well, and discharged the Duties of their Station, whereas those who had done otherwise were Vagabonds, wandering about and frightening People, called *Lares* and *Lemures*.

The *Lares* were also called *Privates*, though improperly, as we'll see by and by, and were worshipp'd under the Figures of little Armourlets or Images of Wax, Silver, or Latten Ware.

The publick *Lares* were also called *Capitales*, from *Capitolium*, a City Way; and *Viales*, from *Via*, a Way, or publick Road, as being placed at the Meeting of Roads, and in the Highways, and esteem'd the Patrons and Protectors of Travellers.

The *Penates*, according to *Julius*, were of the Number of those Gods called *Diæ domatiles*; who were supposed to be the Souls of Men changed into Gods, and were of two kinds, viz. the *Lares* and *Privates*.

As the *Lares* were the same with the *Lares*, at least some of the *Lares* were denominated *Viales*; hence the two Names are sometimes joined, and those High-

way Deities called *Lares Viales*; which see also in *Gruter*:

FORTUNAE
REDUCI LAR
VIALI ROMAE
AETERNAE
Q. AXTUS AELIA
NUS-VE. P. P. C.
AUG.
ZONI.

Their private *Lares* took Care of particular Houses and Families: These they also called *Privates*, or *Præflos*.

Quod præstant oculis omnia tuta sunt. *Ovid. l. 1.*

They gave the Name *Urbanæ*, i. e. *Lares urbani*, to those who had Cities under their Care, and *Rustici* to those who were to keep their Enemies off. There were also *Lares* of the Country, called *Rustici*, as appears by several antique Inscriptions.

The *Lares* were also genial Gods, and were supposed to take Care of Children from their Birth. For this Reason, that when *Macrobius* tells us the *Egyptians* had four Gods, who presided over the Birth of Children, viz. the *Genius*, *Fortune*, *Love*, and *Necessity*, called *Præflos*, some interpret him as if he had said the *Egyptians* had *Lares*; but there was a World of Difference between the *Lares* of the *Romans*, and the *Præflos* of the *Egyptians*.

The Ancients differ extremely about the Origin of the *Lares*. *Varro* and *Macrobius* say, they were the Children of *Mania*; *Ovid* makes them the Issue of *Morans* and the *Naiad Lara*, whom *Lactantius* and *Apuleius* call *Larunda*; *Apuleius* assures us, they were the Possessors of the *Lemures*; *Nigidius*, according to *Ambrosius*, made them, sometimes, the Guardians and Protectors of Houses, and sometimes the same with the *Curies* of *Samothracia*, which the *Greeks* call *Idæi Dætylæ*. Nor was *Varro* more consistent in his Opinion of these Gods; sometimes making them the Manes of Heroes, and sometimes Gods of the Air.

T. Tatius King of the *Sabines*, was the first who built a Temple to the *Lares*. The Chimney and Fire-Place in the House were particularly consecrated to them. Though *John Sheffield*, Duke of *Buckingham*, turned his out of Doors, and placed them at the Top of his House, some have imagined by a Principle of Compassion, because as they were starved within, they could, out of Doors feed, at least on the Air, like the *Cameleon*; therefore it is not surprizing, that that ingenious Gentleman himself said, that they were very glad to be there; *Sic fidi lætantur Lares*.

Tertullian tells us, the Custom of worshipping the *Lares* arose from this, that they anciently interr'd their Dead in their Houses; whence the credulous People took Occasion to imagine, their Souls continued there also, and proceeded to pay them divine Honours. To this it may be added, that the Custom being, afterwards introduced of burying in the Highways, they might hence take Occasion to regard them as Gods of the Highways.

The Victim offered to the *Lares* in the publick Sacrifices was a Hog: In private they offer'd them Wine, Incense, a Crown of Wool, and a little of what was left at the Table. They also crown'd them with Flowers, particularly the Violet, Myrtle, and Rosemary. Their Symbol was a Dog, which was usually represented by their Side, on Account of its Fidelity, and the Service he does to Man in watching his House. They were also represented as clothed in a Dog's Skin.

M. Baudet, on a Dissertation on the *Lares*, without the *Panthæon*, to have had their Rite from the Supplication of those, who taking several Gods for the Protectors of their Houses, united them all in the same Rite, by adoring it with the several Symbols proper to each of those Deities.

In effect, the *Panthæon*, among the Ancients, was a single Statue, composed of the Figures or Symbols of several different Deities combined.

F. Joubert, who calls them *Privates*, and who has preserved them on several Medals, says, that the

most commonly adored with Symbols or Attributes belonging to several Gods.

An Instance hereof, we have in a Medal of *Antoninus Pius*; which at the same Time represents *Serapis*, by the Bushel it bears; the Sun by the Crown of Rays; *Jupiter Ammon* by the Ram's Horns; *Pluto* by the large Beard, and *Æsculapius* by the Serpent twisted in his Hand.

The Term *PENATES*, being applied to the domestick Gods, whom the Antients adored in their Houses, was the Occasion that the *Penates* were ordinarily confounded with the *Lares*.

Authors are not at all agreed about the Origin of the *Dii Penates*, who were properly the tutelary Gods of the *Trojans*, and were only adopted by the *Romans*, who gave them the Title of *Penates*.

De Meziriack, in his Notes on the Epistle of *Dido* to *Æneas*, relates at large what he has met withal in the antient Writers on this Subject: *Dionysius Halicarnassensis* tells us, that *Æneas* first lodged these Gods in the City *Lavinium*; and that his Son *Ascanius* afterwards, upon building the City *Alba*, translated them thither; but that they returned twice miraculously to *Lavinium*. The same Author adds, that in *Rome* is still seen a dark Temple, shaded by the adjacent Buildings, wherein are the Images of the *Trojan* Gods, with the Inscription *Denas* which signifies *Penatus*.

These Images represent two young Men sitting, each of which holds a Lance. I have seen, adds *Dionysius*, several other Statues of the same Gods, in antient Temples, who all appear like young Men dressed in a Habit of War.

Varro fetches these *Penates* from *Samothrace* to *Phrygia*, to be afterwards transported by *Æneas* into *Italy*. *Macrobius*, who relates this from *Varro*, adds that they were called *Penates*, from the Latin Words *per quos penitus spiramus*, which seems a meer Subtlety. But the real Etymology must be sought in the *Phrygian*, not in the Latin Tongue.

Cicero, in *Aulus Gellius*, derives the Name hence, *quod penes nos nati sunt*. Yet in his Book *de nat. deor.* he says it is formed from *Penus*, Provision; or perhaps, adds he, *quod penitus insident*; others say, *quia coluntur in penetralibus*.

Rosinus distinguishes among the *Penates*: He makes an Order of the *Penates* of the Heavens, such as *Pallas* in the ethereal Region, *Jupiter* in the middle Region, and *Juno* in the lowest; besides *Penates* of Cities, *Penates* of private Families, &c. on which footing the *Dii Penates* were the Guardian or tutelary Gods of every Thing.

It is a popular Question among the Learned, who were the *Penates* of *Rome*? Some say *Vesta*, others *Neptune* and *Apollo*; *Vives* says *Castor* and *Pollux*, with whom agrees *Vossius*, who adds, that the Reason of their choosing *Castor* and *Pollux* in Quality of *Penates*, might be the important Service they did the *Romans* in the War against the *Latins*.

Nor are Authors more unanimous on the Subject of the *Penates*, which *Æneas* brought into *Italy*; some say they were *Neptune* and *Apollo* who built the Walls of *Troy*; others *Jupiter*, *Juno*, and *Minerva*; others *Cælus* and *Terra*.

The *Penates* were also called sometimes *Denates*.

Dionysius Halicarnassensis, lib. 1. speaking of the *Dii Penates*, tells us, that the Historian *Timæus* has wrote, that the Statue, Figure, or Effigy of the *Denates* or *Penates*, was nothing but a crooked Iron, or Copper Rod, and a *Trojan* Vessel of Pottery Ware: And that this was all *Æneas* brought from *Troy*. The same *Dionysius* adds, that the Reason why the *Penates* are often found written *Denates*, is, that the Antients before the Invention of the Letter *P*, used a *D* instead thereof: But *Dionysius* might be mistaken, for the Bottom of the *P* is frequently so very small on Medals, that there is no sensible Difference between a *P* and a *D*, which might be the Occasion of his Mistake; for that the antient Inhabitants of *Italy* had no *P*, is a gross one sufficiently refuted by many proper Names still remaining of the most early Ages, e. g. *Capys*, *Capetus*, *Picus*, *Pallas*. Nor were the *Trojans* without the same, witness *Palinurus*, *Paris*, *Priamus*, &c. The *Penates* were called also tutelary Gods.

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LEMURES, were Spirits or Hobgoblins; restless Ghosts of departed Persons who return to terrify and torment the Living.

These are the same with *Larvæ*, which the Antients imagined to wander round the World to frighten good People, and plague the bad. For which Reason at *Rome* they had *Lemuria*, or Feasts, instituted to appease the Manes of the Deceased.

Apuleius explains the antient Notion of the Manes thus: The Souls of Men released from the Bands of the Body, and free from performing their bodily Functions, become a Kind of Demons or Genii, formerly called *Lemures*. Of these *Lemures*, those that were kind to their Families, were called *Lares familiares*; but those who for their Crimes were condemned to wander continually, without meeting with any Place of Rest, and terrified good Men, and hurt the Bad, are vulgarly called *Larvæ*.

An antient Commentator on *Horace*, mentions, that the *Romans* wrote *Lemures* for *Remures*; which last Word was formed from *Remus*, who was killed by his Brother *Romulus*, and who returned to Earth to torment him.

But *Apuleius* observes, that in the antient Latin Tongue, *Lemures* signifies the Soul of a Man separated from the Body by Death.

Note, That the Antients used, also, to call the Gods above-mentioned *Indigetes*. There are various Opinions about the Origin and Signification of this Word; some pretending it was given to all the Gods in general; and others only to the Semi-Gods or great Men deified: Others say it was given to such Gods as were originally of the Country, or rather such as were the Gods of the Country that bore this Name; and others again hold it was ascribed to such Gods as were Patrons and Protectors of particular Cities. Those of the first Opinion maintain, that the Gods were so called by *Antiphrasis*, because they wanted nothing; the Word coming from the Verb *Indigo*, I want. If this were true, the Word *Indigetes* would signify nearly the same Thing in Latin, with the Hebrew *עז שדדאי*, which the Scripture frequently gives to God; as signifying that he is sufficient from himself and needs nothing. Those of the second Opinion derive the Word from *Indigitare*, to call, invoke; it being these Gods who were ordinarily invoked, and who lent the readiest Ears to the Vows that were made them. To this Purpose they cite *Macrobius*, who uses the Word *Indigitare* in that Sense; telling us the Vestals make their Invocations thus, *Apollo Physician! Apollo Parent! Vestales ita indigitant, Apollo Medice! Apollo Parent!* They add, that their Books of Prayers and of Invocation were called *Indigitamenta*. Lastly, others hold *Indigetes*, to be derived from *Inde genitus*, or in loco degens, or from *inde*, and *ago*, for *dego*, I live, I inhabit; which last Opinion seems the most probable. In effect, it appears, 1. That these *Indigetes* were also called local Gods, *Dii locales*, or topical Gods, which is the same Thing. 2. The *Indigetes* were ordinarily Men deified, who indeed were, in Effect, local Gods, being esteemed the Protectors of those Places where they were deified, so that the second and third Opinion are very consistent. *Virgil* joins *Patrii* with *Indigetes* as being the same Thing, *Geor. 1. Dii patrii indigetes*. 3. The Gods, to whom the *Romans* gave the Name *Indigetes*, were *Faunus*, *Vesta*, *Æneas*, *Romulus*, all the Gods of *Italy*; and at Athens *Minerva*, says *Servius*; at Carthage *Dido*. — It is true we meet with *Jupiter indiges*, but that *Jupiter indiges* is *Æneas*, not the great *Jupiter*; as we may see in *Livy*, lib. 1. c. 3. in which last Sense, *Servius* assures us, *Indiges* comes from the Latin *in Diis ago*, I am among the Gods.

The Antients called their Demi-gods *Heroes*, who were illustrious Persons of mortal Nature; tho' by the Populace supposed to partake of Immortality; and, after their Death, placed by them in the Number of the Gods.

Heroes were, properly, Persons partly of divine, and partly of human Extraction, being got between a Deity and a Mortal: As *Achilles*, who was the Son of the Goddess

Goddeſs *Thetis* by *Peleus*; and *Hercules* who was the Son of *Jupiter* by *Almena*.

A *Hero* then, coincides with what we otherwiſe call a *Demi-God*; accordingly *Lucian* defines a *Hero* to be a Medium between God and Man, or rather a Composition of both.

Note, That the Word *Hero* was formed from the *Latin heros*, and that of the *Greek ἥρως*, *Semi-Deus*, *Demi-God*. *St. Auguſtin*, *de civit. Dei*. lib. 10. obſerves, that it is highly probable, ſome one of *Juno's* Sons was originally called by this Name, that Goddeſs being called in *Greek Ἥρα*; or it may be, that great Men were diſtinguiſhed by that Appellation, in Alluſion to the Opinion of the Antients, that virtuous Perſons after their Death inhabit the wide Expanſe of the Air, which is *Juno's* Province. *Iſidore* inclines to think, that Heroes were thus called *Quaſi aëroes*, *aerei*, Perſons of ſuperior Merit and worthy of Heaven. *Plato* derives the Word from the *Greek ἥρως*, Love, as intimating the Hero's to have ariſen from the Copulation of a God with a mortal Woman, or of a Goddeſs with a Man. Others derive the Name from the *Greek εἰπεῖν*, *dicere*, to ſpeak; the Heroes being Perſons who by their Eloquence led the People at their Pleaſure: Others, laſtly, derive it from the *Greek ἔργα*, *terra*, Earth; the Heroes on their Principle, being the *Dii terreſtres*, or Gods of the Earth.

The Heroes were tranſlated into Heaven, by a Ceremony called *Apotheoſis*, from a Propoſition *απο* and *Θεός*, *Deus*, God.

After the *Apotheoſis*, which they alſo called *Deification* and *Conſecration*, Temples, Altars, and Images, were erected to the new Deity; Sacrifices, &c. were offered, and Colleges of Priests inſtituted; and even the Senate decreed that Oaths ſhould be taken in their Names.

It was one of the Doctrines of *Pythagoras*, which he had borrowed from the *Chaldees*, that virtuous Perſons after their Death were raiſed into the Order of the Gods.

And hence the Antients deified all the Inventors of Things uſeful to Mankind, and thoſe who had done any important Service to the Commonwealth. *Tiberius* propoſed to the *Roman Senate* the *Apotheoſis* of *Jeſus Chriſt*, as is related by *Eusebius*, *Tertullian*, and *St. Chryſoſtom*. *Juvenal* rallying the frequent *Apotheoſes*, introduces poor *Atlas* complaining that he was ready to ſink under the Burthen of ſo many new Gods as were every Day added to the Heavens.

Seneca ridicules the *Apotheoſis* of *Claudius* with admirable Humour. *Herodian*, lib. 4. in ſpeaking of the *Apotheoſis* of *Severus*, gives us a very curious Deſcription of the Ceremonies uſed in the *Apotheoſis* of the *Roman Emperors*. After the Body of the deceased Emperor, ſays he, had been burnt with the uſual Solemnities, they placed an Image of Wax, perfectly like him, but of a ſickly Aſpect, on a large Bed of Ivory, covered with a Cloth of Gold in the Veſtibuſe of the Palace. The greateſt Part of the Day the Senate ſat ranged on the left Side of the Bed, dreſſed in Robes of Mourning; the Ladies of the firſt Rank ſitting on the right Side in plain and white Robes, without any Ornaments. This laſted for ſeven Days ſucceſſively, during which, the Phyſicians came from Time to Time to viſit the Sick, always making their Report that he grew worſe, till at length they publiſhed that he was dead.

This done, the young Senators and *Roman Knights* took the Bed of State upon their Shoulders, carrying it through the *Via Sacra*, to the old Forum, where the Magiſtrates uſed to diſſolve themſelves of their Offices; there they ſet it down between two Kinds of Amphitheatres, in the one whereof were the Youths, and in the other the Maidens of the firſt Families of *Rome*, ſinging Hymns ſet to ſolemn Airs in Praiſe of the Deceased. Theſe Hymns ended, the Bed was carried out of the City into the *Campus Martius*, in the Middle of which was erected a Kind of ſquare Pavilion, the Inſide whereof was full of combuſtible Matters, and the Outſide hung with Cloth of Gold, and adorned with Figures of Ivory, and various Paintings.

Over this Edifice were ſeveral others, like the firſt in Form and Decoration, always diminiſhing and grow-

ing ſlenderer towards the Top. On the ſecond of theſe was placed the Bed of State, and a great Quantity of Aromates, and odoriferous Fruits and Herbs were thrown all around; after which the Knights made a Proceſſion or Cavalcade in a ſolemn Manner around a Pile, ſeveral Chariots alſo run round it, thoſe who conducted them being clad in Purple Robes, and bearing the Images of the greateſt *Roman Emperors* and Generals.

This Ceremony ended, the new Emperor came to the Catafalca, or Pile, with a Torch in his Hand; and at the ſame time Fire was ſet to it, on all Sides, the Spices and other Combustibles, kindling all at once.

While this was doing, they let fly from the Top of the Building an Eagle, which mounting into the Air with a Firebrand, carried the Soul of the deceased Emperor along with it into Heaven, as the *Romans* believed; and thenceforward he was ranked among the Gods.—It is for this Reaſon, that the Medals, wherein *Apotheoſes* are repreſented, have uſually an Altar with Fire upon it; or however an Eagle taking its Flight into the Air, and ſometimes two Eagles.

Note, That the *Apotheoſis* is alſo called *Conſecratio*.

On Medals, the *Conſecration* is thus repreſented: On one Side is the Emperor's Head, crowned with laurel, ſometimes veiled, and the Inſcription gives him the Title of *Divus*; on the Reverse is a Temple, a Buſtum, an Altar, and an Eagle taking its Flight towards Heaven, either from off the Altar, or from a Cippus: At other Times the Emperor is ſeen in the Air, borne up by the Eagle; the Inſcription always *CONSECRATIO*.—Theſe are the uſual Symbols; yet on the Reverse of *Antoninus*, is the *Antonine Column*.—In the *Apotheoſis* of Empreſſes, inſtead of an Eagle is a Peacock.—For the Honours rendered thoſe Princes after Death, they were explained by the Words *Conſecratio*, *Pater*, *Divus*, and *Deus*.—Sometimes around the Temple, or Altar, are put *Memoria ſcæ*, or *Memoria eterna*: For Princeſſes, *Æternitas*, and *Sideribus recepta*; on the Side of the Head *Dia*, or *Dea*.

DÆMONS, are alſo of their firſt Claſs of Gods; the firſt Notion whereof was brought from *Chaldea*, whence it ſpread itſelf among the *Persians*, *Egyptians*, and *Greeks*. *Pythagoras* and *Thales* were the firſt who introduced *Dæmons* into *Greece*. *Plato* fell in with the Notion, and explained it more diſtinctly and fully than any of the former Philoſophers had done. By *Dæmons* he underſtood Spirits inferior to Gods, and yet ſuperior to Men; which inhabiting the middle Region of the Air, kept up the Communication between Gods and Men, carrying the Offerings and Prayers of Men to the Gods, and bringing the Wills of the Gods to Men. But he allowed of none but good and beneficent ones; though his Diſciples afterwards finding themſelves unable to account for the Origin of Evil, adopted another Sort of *Dæmons* who were Enemies to Men.

There is nothing more common in the heathen Theology, than theſe good and evil Genii. And the ſame ſuperſtitious Notion got footing among the *Hebræes*, by their Commerce with the *Chaldeans*. But by *Dæmons* they did not mean the Devil, or evil Spirits, they never took the Word *Dæmon* in that Senſe, nor was it uſed in ſuch a Signification, but by the Evangelists and ſome modern *Jews*: The Word is *Greek Δαίμων*.

Gale endeavours to ſhew, that the Origin and Inſtitution of *Dæmons*, was an Imitation of the Meliſians. The *Phœnicians* called them *Baalim*, for they had one ſupreme Being, whom they called *Baal* and *Moloch*, and various inferior Deities called *Baalim*, whereof we find frequent Mention in the Old Teſtament: The firſt *Dæmon* of the *Egyptians* was *Mercury*, or *Thoth*. The ſame Author finds ſome Reſemblance between the ſeveral Offices aſcribed to the *Dæmons*, and thoſe of the *Melians*.

The ſecond Claſs of Gods, were the heavenly Bodies as the *Sun*, *Moon*, and other Planets; the fixed Stars, *Conſtellations*, &c.

The *Sun*, was the God of the *Phœnicians*. *Antoninus Heliogabalus*, who had been Priest of the Sun among them, having been elected to ſucceed *Optimus Maximus* in the Empire, brought his God along with him to *Rome*.

Rome, and commanded he should be adored by the whole World, to the Exclusion of all others. He caused a Temple to be built for him, of which himself was the Priest, and wanted that the Fire, kept in that of *Vesta*, should be carried thither, together with the consecrated Bucklers.

The *third Class* was composed of the Elements, as *Earth, Ocean, Ops, Vesta, the Rivers, Fountains, &c.*

The Antients called the Divinities, which they supposed to inhabit the Sea, *Nereides*, who were fifty in Number, all the Daughters of *Nereus*, by the Nymph *Doris*: And those who inhabited Rivers, Fountains, &c. *Naiades*. *Strabo* says, the *Naiades* were Priestesses of *Bacchus*.

The *fourth Class* contained *Meteors*: Thus the *Perseans* adored the Wind; Thunder and Lightning were honoured under the Name of *Geryon*: And several Nations of *India* and *America*, have made themselves Gods of the same. *Castor, Pollux, Helena, and Iris*, have also been preferred from Meteors to be Gods; and the like has been practised with regard to Comets; witness that which appeared at the Murder of *Cæsar*. *Socrates* deified the Clouds, if we may give Credit to *Aristophanes*; and the Primitive Christians, *Tertullian* assures us, were reproached with the same Thing.

In the *fifth Class* they erected Minerals, or Fossils into Deities; such was the *Bætylus*; the *Finlanders* adored Stones; the *Scythians* Iron; and many Nations Silver and Gold.

The *sixth Class* consisted of Plants: Thus *Leeks* and *Onions* were Deities in *Egypt*. The *Sclavi, Lithuanians, Chæ, Vandals, and Peruvians*, adored Trees and Forests: The antient *Gauls, Britons, Druids*, bore a particular Devotion to the Oak; and it was no other than Wheat, Corn, Seed, &c. that the Antients adored under the Names of *Ceres* and *Proserpina*.

The Deities who inhabited the Forests and Trees, were called *Dryades* and *Hamadryades*.

The *Dryades*, were imagined to hide themselves under the Bark of the Oak, called by the *Greeks* *Δρυς*.

The *Dryades* differed from the *Hamadryades*, in that these latter were attached to some particular Trees with which they were born, and with which they died; whereas the *Dryades* were the Goddesses of the Trees and Woods, and lived at large in the Middle thereof. For though *Δρυς* properly signifies an Oak; it was also used for Tree in general.

We likewise find Mention made in divers Authors, of a Kind of Prophetesses, or Witches among the *Gauls*, called *Dryades*, or rather *Druids*; the Authors of the *Historia Augusta*, particularly *Lampridius* and *Vopiscus* make mention hereof. A *Druid*, says *Lampridius*, p. 135. told *Alexander Severus* something which denoted he should be unhappy. *Vopiscus*, in the Life of *Aurelian*, relates, that having consulted the Gaulish *Druids*, whether or no the Empire should remain in his Family; they gave him for Answer, that no Name should be more glorious in the Empire, than that of the Descendants of *Claudius*. On which the Historian takes Occasion to observe, that *Constantius*, Father of *Constantine* the Great, was a *Claudius*.

Lastly, the same *Vopiscus*, in his Life of *Numerianus*, relates, that a *Druid* had foretold *Dioclesian* he should be Emperor, when he should have killed *Aper*, which figured a Boar, and was the Name of a *Præfatus Prætor*, whom he killed with his own Hand.

Saumaife, in his Notes on *Lampridius*, is a little in Doubt who these Women were: But he gives into the most easy and plausible Opinion, that they were either the Wives, or the Children of the *Druids*; which *Druids* were the Priests, or Ministers of Religion, among the antient *Celtæ* or *Gauls, Britons* and *Germans*.

The *Druids* were the first, and most distinguished Order among the *Gauls* and *Britons*: They were chose out of the best Families; and the Honours of their Birth, joined with those of their Function, procured them the highest Veneration among the People. They were versed in Astrology, Geometry, Natural Philosophy, Politicks, and Geography; and had the Administration of all sacred Things; were the Interpreters of Religion, and the Judges of all Affairs indifferently: Whoever refused Obedience to them, was declared impious and accursed.

We know but little as to their peculiar Doctrines; only that they believed the Immortality of the Soul; and, as is generally supposed, the *Metempsychosis*: Tho' a late Author makes it appear highly probable they did not believe this last, at least in the Sense of the *Pythagoreans*.

They were divided into several Classes or Branches, viz. the *Vacerri, Bardi, Eubages, Semnotii* or *Semnothei*, and *Saronide*.—The *Vacerri* are held to have been the Priests; the *Bardi*, the Poets; the *Eubages*, the Augurs; and the *Saronide*, the civil Judges, and Instructors of Youth. As to the *Semnothei*, who are said to have been immediately devoted to the Service of Religion, it is probable they were the same with the *Vacerri*.

Strabo however, lib. 4. p. 197. and *Picard* after him, in his *Celtopædia*, do not comprehend all these different Orders under the Denomination of *Druids*, as Species under their Genus, or Parts under the Whole; but make them quite different Conditions, or Orders.

Strabo, in Effect, only distinguishes three Kinds, *Bardi, Vates*, and *Druids*. The *Bardi* were the Poets; the *Vates* (apparently the same with the *Vacerri*) were the Priests and Naturalists; and the *Druids*, besides the Study of Nature applied themselves likewise to Morality.

Diogenes Laertius assures us in his Prologue, that the *Druids* were the same among the antient *Britons*, with the *Sophi* or Philosophers among the *Greeks*, the *Magi* among the *Persians*, the *Gymnosophists* among the *Indians*, and the *Chaldeans* among the *Assyrians*.

The *Druids* had one chief or *Arch-Druid* in every Nation, who acted as High-Priest, or *Pontifex Maximus*. He had absolute Authority over all the rest, and commanded, decreed, and punished at Pleasure. At his Death he was succeeded by the most considerable among his Survivors; and if there were several Pretenders, the Matter was ended by an Election, or put to the Decision of Arms.

The *Druids*, we have observed, were in the highest Esteem: They presided at Sacrifices and other Ceremonies, and had the Direction of every Thing relating to Religion. The *Gaulish* and *British* Youth flocked to them in Crouds to be instructed by them. The Children of the Nobility, *Mela* tells us, retired withal into Caves, or the most desolate Parts of Forests; and kept them there, sometimes for twenty Years, under their Discipline.

Besides the Immortality and *Metempsychosis*, they were instructed in the Motion of the Heavens, and the Course of the Stars, the Magnitude of the Heavens, and the Earth, the Nature of Things, the Power and Wisdom of the Gods, &c. They preserved the Memory and Actions of great Men in their Verses, which they never allowed to be wrote down, but made their Pupils get them off by Heart: In their common Course of Learning, they are said to have taught them 24,000 such Verses.

They had the Mistletoe in singular Veneration. *Pliny* relates the Ceremony wherewith they gathered it every Year, Lib. xvi. c. 44. They placed a World of Confidence in Serpents Eggs gathered after a peculiar Manner, and under a certain Disposition of the Moon, described by *Pliny*; and imagined them effectual Means for the gaining of Law-Suits, and procuring the good Graces of Princes. And hence it is, the same Author concludes, that the *Caduceus*, or Rod, encompassed with two Serpents interwove, has been assumed as a Symbol of Peace.

Suetonius, in his Life of *Claudius*, assures us, they sacrificed Men; and *Mercury* is said to be the God they offered these inhuman Victims to. *Diod. Sicul. lib. 6.* observes, it was only upon extraordinary Occasions they made such Offerings; as to consult what Measures to take, to learn what should befall them, &c. by the Fall of the Victim, the taring of its Members, and the Manner of its Blood gushing out. *Augustus* condemned the Custom; *Tiberius*, and *Claudius*, punished and abolished it.

We learn from *Cæsar*, that they were the Judges and Arbiters of all Differences and Disputes, both publick and private; took Cognizance of Murders, Inheritances, Boundaries and Limits, and decreed Rewards and Punishments. Such as disobeyed their Decisions they ex-

communicated,

communicated, which was their principal Punishment; the Criminal being hereby excluded from publick Assemblies, and avoided by all the World; so that no Body durst speak to him for Fear of being polluted. *Strabo* observes, they had sometimes Interest and Authority to stop Armies upon the Point of engaging; and accommodate their Differences.

They held an Assembly every Year at a certain Season about the Middle of the Country; and there in a Place consecrated for the Purpose, kept their Assizes, and terminated the Differences of the People, who flocked from all Parts.

Cæsar, who had seen some of the *Druids* in *Britain*, was of Opinion, they had come thence into *Gaul*: Divers among the Moderns take this for a Mistake, and believe the very contrary. In Effect, it appears pretty probable, that the antient *Britons* were originally *Gauls*; that some of the *Celtæ*, or *Belgæ*, *Gaulish* Nations, were the first that entered the Island and peopled it; and that the *Druids* went along with them.

Honorius, in his History of Philosophy, *Lib. II. c. 12.* believes all the Learning and Philosophy of the *Druids* to have been derived from the *Affyrian* Magi, who are still called in *Germany* *Trutten*, or *Trutner*; and that as *Magus* has lost its antient Signification, which was honourable, and now signifies a Magician, or Sorcerer; *Druid*, which had the same Sense, has likewise degenerated, and now signifies no other than a Person who has Commerce with the Devil, or is addicted to Magick: And accordingly in *Friseland*, where there antiently were *Druids*, Witches are now called *Druids*.—*Gale*, *Dickenson*, and some others vainly contend, that the *Druids* borrowed all their Philosophy, as well as Religion, from the *Jews*.

From this long, though necessary Digression, which was occasioned by my mentioning the *Dryades*, I'll pass to the *Hamadryades*.

Poets frequently confound the *Hamadryades* with the *Naiades* and *Napææ*. *Festus* calls them *Querquetulanæ*, as being issued, or sprung from Oaks. An antient Poet, one *Pherenicus*, in *Athenæus*, *lib. 3.* calls the Vine, Fig-Tree, and other Fruit Trees, *Hamadryades*, from the Name of their Mother Oak.

There was also a Kind of Semi-God, called *SATYRS*, who with the *Fawns* and *Sylvans* presided over Groves and Forests, under the Direction of *Pan*.

The *Satyrs* were painted half Men, and half Goats, the upper Part was human, excepting for Horns on the Head; the lower Brutal, with the Tail and Legs of a Goat; the whole covered with Hairs.

The Poets usually confound the *Satyrs*, *Sylvans*, *Sileni*, *Fawns*, and *Panes*.

Nonnus in his *Dionysiaca*, makes the *Satyrs* the Offsprings of *Mercury*, and a *Dorick* Nymph, called *Tptbima*, and gives us the Names of several, viz. *Præminius*, *Thyasus*, *Hypsichorus*, *Oristas*, *Apæus*, *Phlegæus*, *Lycao*, &c. *Memnon* in his Book against the Tyrants of *Heraclea*, derives the *Satyrs* from *Bacchus*, and a *Naiad*, called *Niræa*.

Though the *Satyrs*, when advanced in Age were called *Sileni*, yet there was one principal *Silenus* older than any of the rest. *Diod. Siculus* says, he was the Master, or Tutor of *Bacchus*, whom he disciplined nobly, and followed him to the Wars. He quotes an antient Poet named *Thymetas*, who relates, that the *Sileni* assisted *Bacchus* in the War he waged against the *Titans*; adding that the first *Silenus* reigned in an Island made by the River *Triton* in *Lybia*. He is represented as having a long Tail hanging behind, which is likewise an Attribute of all his Posterity: The Poets always mount him on an Ass.

Nonnus makes *Silenus* a Son of *Tellus*, and gives him three Sons, *Astræus*, *Maron*, and *Leneus*. *Servius* on *Virgil's Eclogues*, makes *Silenus* the Son of *Mercury*, others the Son of *Pan*, and a Nymph; others will have him born of the Drops of the Blood of *Cælus*, Father of *Saturn*.

Note, That *Bochart*, in his *Canaan*, will have *Silenus* to take his Name from שִׁילֹן, or שִׁילָה, *Silo*, whence שִׁילָה, *Silan*, the Name of the *Messiah*. He adds, that all attributed to this imaginary Deity, is taken from what

the Prophets have foretold of *Jesus Christ*. Thus whereas it is said, the *Messiah* shall be the Instructor of the People; *Silenus* is made Preceptor of *Bacchus*. Because it is said that our Saviour shall bind his Ass to the Vine, and his Colt to the young Vine; *Silenus* is made to ride on an Ass. Because our Saviour washed his Garments in Blood, as those who trod the Vine-Press; *Silenus* was made to preside over those who pressed the Vintage. Because it is added, his Eyes were red by reason of Wine; *Silenus* was made always fuddled. *Bochart* however, advances this with a deal of Distrust, as he has Reason, it having no Warrant: He adds, that the Devil invented the Fable of *Silenus* to turn the Mysteries of our Religion into Ridicule. But it must be a very ignorant Devil, to take *rubent illi oculi ex vino, & dentes ejus ex lacte albescent*, in the Sense he has done, as if the Words signified any Thing more in the Propriety of the *Hebrew* Tongue, than his Eyes are redder than Wine; his Teeth whiter than Milk. We may add, that no Body, before *Bochart*, neither Christian, nor Idolater, ever saw any Thing of *Jesus Christ* in the Fable of *Silenus*.

The *FAUNS*, were also a Species of Demi-Gods, inhabiting the Forests.

The *Fauns* are reputed pure *Roman* Deities; unknown to the *Greeks*.—They were represented, like the *Satyrs*, half Men, half Goats, a very flat Nose, and the rest human.

The *Roman Faunus* was the same with the *Greek Pan*. Now, in the Poets, we find frequent Mention of *Fauns* and *Panes*, in the plural Number; in all Probability, therefore, the *Fauns* were the same with the *Panes*.

The Reason was, that there were several *Faunus's* and *Pans*; though all descended from a principal one. Thus *Ovid*:

*Aut quas Semi-deæ, Dryades, Faunique bicornes,
Numine contactas attonuere suo.*

The *Romans* called them *Fauni*, *Ficarii*. The Denomination *Ficarii* was derived not from the Latin *Ficus*, *Ficus*, a Fig, as some have imagined; but from *Ficus*, *Fici*, a Sort of fleshy Tumour, or Excrescence growing on the Eye-lids, and other Parts of the Body; with which the *Fawns* were represented.

Though the *Fawns* were held for Demi-Gods, yet were they supposed to die after a long Life. *Arnobius* shews, that their Father or chief *Fawn* himself only liv'd 120 Years.

The seventh Class of Gods, was taken from among the Waters: The *Syrians* and *Egyptians* adored Fishes; the *Oxyrhynchites*, *Latopolitani*, *Sinaitæ*, and Inhabitants of *Eliphantis* had each a Fish for their God; and the *Tritons*, *Nereides*, *Syrens*, &c. what were they but Fishes? Several Nations have adored Serpents, particularly the *Egyptians*, *Prussians*, *Lithuanians*, *Samogitians*, &c.

The *TRITON* was a Sea Semi-God, held by the Antients to be an Officer, or Trumpeter of *Neptune*, attending on him, and carrying his Commands from Sea to Sea.

The Poets and Painters, represent him as a half Man, and half Fish, terminating in a Dolphin's Tail, and bearing in one Hand a Sea Shell, which served as a Trumpet.

Some of the Antients make him the Son of *Neptune*, and the Nymph *Salacia*; *Hesiod* of *Neptune* and *Amphitrite*; *Neumenius* in his Book *de piscationibus*, makes him the Son of *Oceanus* and *Thetys*; and *Licophon* the Son of *Nereus*.

But though *Hesiod*, and the *Mythologists*, only speak of one *Triton*, the Poets have imagined several; giving some of them for Trumpeters to all the Sea-Gods, particularly to *Neptune* and *Venus*; accordingly they were frequently introduced into the antient Theatres, and in the *Naumachia*.

In Effect, the *Tritons* not only officiated as Trumpeters in *Neptune's* Retinue, but were also supposed to draw his Chariot, i. e. the Sea-Shell wherein he rode over the Waters; as we find in *Virgil*, *Æneid* x. 209. *Ovid Metam.* i. 333. and on a Medal of *Claudius*.

The Fable of the *Tritons* no doubt, took its Rise from

Sea or Mer-men; for that there are such Things as Sea-men, seem a Thing scarce to be doubted.

The Poets ordinarily attribute to *Triton* the Office of calming the Waves, and of making Tempests cease. Thus in the first of the *Metamorphoses* we read, that *Neptune* desiring to recall the Waters of the Deluge, commanded *Triton* to sound his Trumpet, at the Noise whereof the Waters all retired.

The *SIRENS*, *Mermaids*, are represented by *Ovid* a Kind of Sea-Monster, with Women's Faces and Fishes Tails; and by others are decked with a Plumage of various Colours.

They are supposed to have been the three Daughters of the River *Archelous*, and called *Parthenope*, *Ligea*, and *Leucofæa*. *Homer* only makes mention of two *Syrens*, but others reckon five. *Virgil* places them on Rocks, where Vessels are in Danger of splitting. *Pliny* makes them inhabit the Promontory of *Minerva* near the Island *Capra*; Others fix them in *Sicily*, near Cape *Pelorus*. *Claudian* says, they inhabit harmonious Rocks, that they were charming Monsters; and that Sailors were wrecked on their Rocks without Regret, and even expired in Raptures; *Dulce malum Pelago Syren*.

This Description is doubtless founded on a literal Explication of the Fable, that the *Sirens* were Women who inhabited the Shores of *Sicily*, and who, by all the Allurements of Pleasure, stopped Passengers, and made them forget their Course. Some Interpreters of the ancient Fables will have the Number and the Names of three *Sirens* to have been taken from the triple Pleasure of the Senses, Wine, Love, and Musick, which are the three most powerful Means of seducing Men; and hence so many Exhortations to avoid the *Sirens* fatal Song.

Probably it was hence that the *Greeks* fetched their Etymology of *Siren*, viz. from *σειρα*, a Chain, as if there was no getting free of their Enticement.

Others, who do not look for so much Mystery in the Fable, maintain that the *Sirens* were nothing but certain Streights in the Sea, when the Waves whirling furiously around, seized and swallowed up Vessels that approached them too near.

Lastly, others hold the *Sirens* to have been certain Shores and Promontories, where the Winds by the various Reverberations and Echo's, cause a Kind of Harmony that surprizes, and stops Passengers. This probably might be the Origin of the *Siren's* Song, and the Occasion of giving the Name of *Sirens* to those Rocks.

Sculptors and Painters usually follow *Ovid's* Description of the *Sirens*; but on some Medals we find them represented with the upper Parts of Women, and the lower of Birds.

In the eighth Class, *Flies* and *Ants* had their Priests and Votaries; these among the *Thebians*, and those in *Arcania*, where *Bullocks* were offered to them.

In the ninth Class among Birds, the Stork, Raven, Sparhawk, Ibis, Eagle, Griffon, and Lapwing, have had divine Honours; the last in *Mexico*, the rest in *Egypt* and at *Thebes*.

In the tenth Class, four-footed Beasts have had their Altars, as the Bull, Dog, Cat, Wolf, Baboon, Lion, and Crocodile, in *Egypt*, and elsewhere; the Hog in the Island of *Crete*, Rats and Mice in the *Troas*, and at *Tenedos*; Weazels at *Thebes*, and the Porcupine throughout all *Zoroaster's* School.

In the eleventh Class, Men were placed among the Number of Deities, and from *Belus*, or *Baal*, to the Roman Emperors before *Constantine*, the Instances of this Kind are innumerable. Frequently they did not wait so long as their Death for the Apotheosis. *Nebuchadnezzar* procured his Statue to be worshipped while living: And *Virgil* shews, that *Augustus* had Altars and Sacrifices offered to him, *Eclog.* 1. v. 6, 7, as we learn from other Hands, that he had Priests called *Augustales*; and Temples at *Lyons*, *Narbona*, and several other Places; and he must be allowed the first of the *Romans*, in whose Behalf Idolatry was carried to such a Pitch. The *Æthiopian* deemed all their Kings Gods; the *Vesteds* of the *German*, the *Janus* of the *Hungarians*; and the *Thaut*, *Weten*, and *Assa* of the northern Nations, were indisputably Men.

In the twelfth Class, not Men only, but every Thing that relates to Men, has been also deified; as Labour,

Rest, Sleep, Youth, Age, Death, Virtues, Vices, Occasion, Time, Place, Numbers, among the *Pythagoreans*, the generative Power, under the Name of *Priapus*; Infancy alone had a Cloud of Deities, as *Vegetanus*, *Levane*, *Rumina*, *Edusa*, *Potina*, *Cuba*, *Cumina*, *Carna*, *Ossilago*, *Statulinus*, *Fabulinus*, &c.

They also adored the Gods, Health, Fever, Fear, Love, Pain, Indignation, Shame, Impudence, Opinion, Renown, Prudence, Science, Art, Fidelity, Felicity, Calumny, Liberty, Money, War, Peace, Victory, Triumph, &c.

Lastly, Nature, the Universe, or *το παν*, was reputed a great God.

Hesiod has a Poem under the Title of *Θεογονία*, i. e. the Generation of the Gods, wherein he explains their Genealogy and Descent, sets forth who was the first and Principal; who next descended from him, and what Issue each had; the whole making a Sort of System of heathen Theology.

Besides this popular Theology, each Philosopher had his separate System, as may be seen from the *Timæus* of *Plato*, and *Cicero de nat. Deor.*

Justin Martyr, *Tertullian* in his *Apologeticks*, and in his Book *Contra gentes*; *Arnobius*, *Minucius Felix*, *Lactantius*, *Eusebius*, *præpar. & Demonstr. Evan.* *St. Augustin*, *de civit. Dei.* and *Theodoret*, *advers. gentes.* shew the Vanity of the heathen Gods.

It is very difficult to discover the real Sentiments of the Heathens, with respect to their Gods; they are exceedingly intricate and confused, and even frequently contradictory. They admitted so many superior and inferior Gods who shared the Empire, that all was full of Gods. *Varro* reckons up no less than thirty Thousand, adored within a small Extent of Ground, and yet their Number was every Day growing. The Way to Heaven was so easy for the great Men of those Days, that *Juvénal*, as we have already observed, brings in *Atlas* complaining he was ready to sink under the Load of such a Number of new Gods as were daily placed in the Heavens; yet *Father Morgues* seems to have proved, that all the Philosophers of Antiquity have acknowledged that there is but one God.

The heathen Divinities had a particular Sort of Priests, or Ministers of their Sacrifices, called *Flamens*, and at *Rome* there were as many Kinds of *Flamens*, as there were Gods who had Sacrifices offered them.

Numa at first only instituted three, one for *Jupiter*, called *Flamen Dialis*; another for *Mars*, called *Flamen Martialis*; and a third for *Romulus*, or *Quirinus*, called *Flamen Quirinalis*.

In After-times twelve more were added, which made the Number of *Flamens* fifteen.

The three first were taken from among the *Patricians*, and were held of a Rank and Distinction superior to the rest. They were called *greater Flamens*, *Flamines majores*; in Contradistinction to the other twelve, who were chose from among the *Plebeians*, and were called *lesser Flamens*, *Flamines minores*. The *Flamen Dialis*, or of *Jupiter*, was the first instituted, and held in the greatest Repute. He bore a peculiar Ornament on his Head called *Abugalerus*, which was made of the Skin of a white Victim, sacrificed to *Jupiter*.

The Cap wore by the rest was called *Flamma* or *Apex*; it was made of a Sheep's Skin, with the Wool on; to it was fastened a little Branch of an Olive-tree. That of the *Flamen* of *Jupiter* ended in a Point called *Titulus*, it was tied under the Chin with Strings. In the Summer time it was a woollen Thread tied round the Head, it being prohibited them to appear quite bare-headed. And hence, according to *Festus*, came their Denomination of *Flamen*, viz. from *flamen* of *Filum*, Thread.

Though the *Flamens* bore one common Appellation, yet did they not constitute any Company or College. Each God had his several Sacrifices, Feasts, and Ceremonies a-part; nor had one *Flamen* any Relation to another, only they were all subordinate to the *Pontifex Maximus*. *Aulus Gellius* assures us, that they were created by the People in the *Comitia Curiate*; but the *Pontifex Maximus* consecrated them; their Priesthood, called *flaminatus*, was perpetual, though on some Occasions they might be deposed.

The Names of the several *Flamens* are as follows;

the three great *Flamens*, as already observed, were the *Flamen Dialis*, *Flamen Martialis*, and *Flamen Quirinalis*. The twelve lesser were, the *Flamen Carmentalis*, or Priest of the Goddess *Carmenta*; *Flamen Falacer*, or Priest of God *Falacer*; a Name, whose Origin, *Varro* observes, is not known: *Flamen Floralis*, or of the Goddess *Flora*; *Flamen Farinalis*, whose Etymology is not known; *Flamen Leuinalis*, *Flamen Lucularis*, *Flamen Palatualis*, whom some Moderns will have the Priest of the Goddess that presided over the *Palatium*; though *Varro* owns himself at a Loss for his Original: *Flamen Pomonalis*, or of *Pomona*, Goddess of Fruits; *Flamen Virbialis*, or of the God *Virbius*, whom some take for the same with

Hippolytus; *Flamen Vulcanalis*, or of *Vulcan*, and *Flamen Voltarnalis*, or of the God *Volturnus*.

They had also their *Flaminæ* or *Flaminicæ*, who were Wives of the *Flamens*, or the Priestesses of the Deities. In an antient Marble, quoted by *Gruter*, p. cccclix. n. 9. the Word *Flamina* is used for Priestesses; and in the same Author, p. cccviii. n. 3. the Priestesses of the Goddess *Feronia*, *FLAM. FERON.* that is, *Flamina*, or *Flaminicæ*.

The *Flamina* bore the same Ornament on her Head with the *Flamen*; she had also the same Surname with her Husband, *Flamina Dialis*, *Martialis*, &c.

NATURAL HISTORY.

NATURAL HISTORY, is a Description of the natural Products of the Earth, Water, or Air, v. gr. Beasts, Birds, Fishes, Metals, Minerals, and Fossils, together with such extraordinary Phænomena, as at any Time appear in the material World, as Meteors, Monsters, &c.

Note, That as I have treated already of all those Things each under its particular Head, viz. of Animals, in a particular Treatise under the Letter A; of Plants in a Treatise of Botany, under the Letter B; of Metals, in a particular Treatise under the Letter M; of Minerals, Fossils, &c. in a particular Treatise likewise, under the same Letter M; it remains only to treat in this Place of few Things, which have been omitted in those several Treatises, viz. of Monsters, scarce, and extraordinary Animals, Plants, &c.

MONSTER, *Monstrum*, is a Birth, or Production of a living Thing, degenerating from the proper and usual Disposition of Parts, in the Species it belongs to.

Aristotle defines a Monster to be a Defect of Nature, when acting towards some End it cannot attain to, by reason some of its Principles are corrupted.

Monsters do not propagate their Kind, for which Reason some rank Mules among the Number of *Monsters*, as also *Hermaphrodites*.

A *Mule*, is a mongrel Kind of quadruped usually generated between an Ass and a Mare, sometimes also between a Horse and a she Ass.

Though Mules do not propagate their Kind, yet the Antients mention a Sort of Mules that were prolifick, in *Phrygia*, *Syria*, *Cappadocia*, and *Africa*. Witness *Aristotle*, *hist. anim.* l. 6. c. 36. *Varro de re Rusticâ*, lib. 2. c. 1. *Columella*, l. 7. c. 36. *Theophrastus*, and after him *Pliny*, lib. 8. c. 44. *Steno* examining the Testicles of a Mule, found Ova therein, with a Sort of Placenta about them, which persuaded him that Mules might engender without any Miracle. But the Observation is fanciful, and the Conclusion unworthy so able a Naturalist.

The *Roman Ladies* had Equipages drawn by Mules, as appears by the Medals of *Julia* and *Agrippa*. And at this Day in *Spain*, the Coaches of the Nobility, and even Princes, are usually drawn by no other than Mules.

A **HERMAPHRODITE**, is a Person who has both Sexes, or the genital Parts, both of Male and Female.

Note, That the Word is formed of the Greek *Ερμαφροδιτης*, a Compound of *Ερμης*, *Mercury*, and *Αφροδιτης*, *Venus*, a Mixture of *Mercury* and *Venus*, i. e. of Male and Female. For it is to be observed *Hermaphroditus* was originally a proper Name, applied by the heathen Mythologists to a fabulous Deity, whom some represent as a Son of *Hermes*, *Mercury*, and *Aphrodite*, *Venus*, and who being desperately in Love with the Nymph *Salmasis*, obtained of the Gods to have his Body and hers united into one. Others say, that the God *Hermaphroditus* was conceived as a Composition of *Mercury* and *Venus*, to exhibit the Union between Eloquence, or rather Commerce, whereof *Mercury* was God; with Pleasure whereof *Venus* was the proper Deity. Lastly, others think this Junction intended to shew that *Venus*, Pleasure, was of both Sexes, as

in Effect the Poet *Calvus* calls *Venus* a God.

Pollentemque Deum Venerem.

And also *Virgil*, *Æneid.* l. 11.

*Discedo ac ducente Deo flammam inter & hostes,
Expedior.*

M. Spon observes, *Hesychius* calls *Venus Aphroditos*; and *Theophrastus* affirms, that *Aphroditos*, or *Venus*, is *Hermaphroditus*; and that in the Island of *Cyprus* she has a Statue, which represents her with a Beard like a Man. The *Greeks* also call *Hermaphrodites* *αὐδερφροδιται*, and *rogyni*, q. d. Men-Women.

Naturalists distinguish four Kinds of *Hermaphrodites*, whereof the last are the perfect *Hermaphrodites*, or those who have the Pudenda of both Kinds; but these are rarely, if ever, found. It is affirmed, however, that there were two such *Hermaphrodites* married to each other.

Others dispute all that has been said on that Subject, maintaining that the ill Conformation of the Parts of Generation, the Testicles being detained or concealed in Men, and the Clitoris longer than ordinary in Women, have been the sole Occasion of the Notion. To which may be added, steatomatous Tumours of the Labia Pudendi, which have sometimes passed for Testicles.

Dr. Quincy thinks, that the frequent Use of lascivious Frictions and Titillations may contribute greatly to the Extension of the Clitoris, and make it pass with the Ignorant for a Penis. This he adds was the Case in the celebrated Instance of the two Nuns at *Rome*, who, after they had lived Women for many Years, became Men. But on what Grounds he asserts this we do not know.

‘The extraordinary Size of the Clitoris, says *Dr. Drake*, and its Propendence sometimes, out of the Body in Infants, makes the Women mistake such Children for that Sort of Monsters called *Hermaphrodites*. Of this Kind I had one brought me, the Clitoris whereof hung out of the Body so far, at about three Years old, that it resembled very much a Penis, but it wanted a Perforation: And instead of that, just behind it the Urine issued at a Hole, which was nothing else but the Corner of the Rima, the Clitoris filling all the rest of the Orifice; so that the Parents mistook it for a Boy, and as such christened it.—But the Neighbours called it an *Hermaphrodite*.’

But we have an authentick Account, in the History of the *Royal Academy of Sciences*, of a real *Hermaphrodite* which may put the Point out of Question. The Person had all the external Characters of a Woman in the Face, Neck, Breast, Hips, and Pudendum, and accordingly had been baptized in that Quality, and named *Margaret*, but had withal the real Characters of a Man, and a very able one. The *Pudendum Muliebre* appeared very well, but was not above two Fingers Breadth deep; out of the Middle of the Rima, or Aperture thereof, hung a pretty bulky Penis, which in an Erection came out eight Inches. The Penis was well formed, except that it had no Prepuce, nor was accompanied with any apparent Testicles. The Urine and Seed came out at it as in Men; and what was very extraordinary, the Menstruum flowed through the same, and this very regular once a Month.

NATURAL HISTORY.



The Person was brought sick at the Hospital of St. James at *Toulouse*, and the Account was given by M. *Veay*, Surgeon of the same Hospital, who adds, that having shewn the whole to several Physicians, and the Vicars General, they ordered the Party to take the Name and Habit of a Man, but not that of a Woman.

Note, That the Interpreters and Commentators on the Civil Laws, hold that an *Hermaphrodite* who has chose the Male Sex, as that which prevails most in him, may no longer do the Office of a Woman. And our *French* Lawyers produce an Arret of the Parliament of *Paris*, whereby a young *Hermaphrodite* was condemned to be burnt on that very Account. At *Athens* and *Rome*, they looked on *Hermaphrodites* as ominous Monsters, and precipitated them into the Sea, as we are informed by *Alexander ab Alexandro*.

S. de Rennefort relates, that at *Surat* there are Abundance of *Hermaphrodites*, who with Womens Cloaths wear Mens Turbans, to distinguish them, and let all the World know they have two Sexes.

In 1376 *Albert*, Bishop of *Bremen*, and Brother of the Duke of *Brunswick*, was accused by *John de Cestervel*, Dean of his Chapter, with being an *Hermaphrodite*, but he cleared himself.

Note, That *J. Frederick Mayor*, a Lutheran Divine, has an express Dissertation, to prove that an *Hermaphrodite* cannot be a Priest; it was printed at *Grypswald* in 1705. And *Willenlorg*, another Lutheran of *Dantzick*, has wrote to prove them excluded from all civil Employments like Women.

Hermaphrodite, is also applied metaphorically to divers other Things besides the human Species.

The latest Botanists and Florists, make a Division of Parts which they call *Hermaphrodites*, as may be seen in my Treatise of Botany under the Letter B, as having both the Male and Female Parts of Generation, viz. the Stamina and Pistil in the same Flower.

Divers of the insect and reptil Kind are also *Hermaphrodites*, particularly Worms, Snails, &c. as may be seen in my Treatise of Animals.

In the Memoirs of the *French* Academy, we have an Account of a very extraordinary Kind of *Hermaphrodites*, which not only have both Sexes, but do the Office of both at the same Time. Such are the Earth-worms, the round-tail Worms found in the Intestines of Men and Horses, Land-Snails, and those of fresh Waters, and all the Sorts of Leaches. And as all these are Reptiles and without Bones, *M. Paupert* concludes it probable, that all other Insects, which have those two Characters, are also *Hermaphrodites*.

The Method of coupling practised in this Class of *Hermaphrodites*, may be illustrated in the Instance of Earth-worms. These little Serpents creep two by two, into Holes proper to receive them, where they dispose their Bodies in such Manner, as that the Head of the one is turned to the Tail of the other. Being thus stretched Length-wise, a little conical Button, or Papilla, is thrust forth by each, and received into an Aperture of the other.

These Animals being Male at one End of the Body, and Female at the other, and the Body flexible withal; *M. Homberg* does not think it impossible but that an Earth-worm may couple with itself; and be both the Father and Mother of its Young; an Observation which to some appears highly extravagant.

The most monstrous Productions in the vegetable World are called *Mules*, which are Monsters produced by putting the Farina Facundans of one Species of Plant into the Pistil, or Utricle of another.

The Carnation and Sweet-william being somewhat alike in their Parts, particularly their Flowers; the Farina of the one will impregnate the other; and the Seed so enlivened will produce a Plant differing from either. An Instance of this was seen in Mr. *Fairchild's* Garden at *Hoxton*, where there was a Plant neither Sweet-william nor Carnation, but resembling both equally; which was raised from the Seed of a Carnation which had been impregnated by the Farina of the Sweet-william. Their Couplings being not unlike those of the Mare with the Ate, which produce the Mule; the

same Name is given them, and they are like the others incapable of multiplying their Species.

This gives us a Hint for altering the Property and Taste of any Fruit, by impregnating one Tree with the Farina of another of the same Class, e. gr. a Codlin with a Pearmain, which will occasion the Codling to impregnated to last a longer Time than usual, and be of a sharper Taste; or if the Winter-Fruits be fecundated with the Dust of the Summer-Seeds, they will decay before their usual Time. And from this accidental Coupling of the Farina of one with another, it may possibly be that in an Orchard where there is Variety of Apples, even the Fruit gathered from the same Tree differ in their Flavour, and in the Season of Maturity. It is from the same accidental Coupling, that proceeds the numberless Variety of Fruits and Flowers raised every Day from Seeds.

Florists give also the Denomination *Monsters*, or monstrous Flowers, to those Flowers which are not only double, but double-podded, as when instead of one Flower there are two or three, raising one above another from one single Stalk.

Note, That Father *Malebranche* accounts for the Production of Monsters in the animal World, thus.—The Creator has established such a Communication between the several Parts of his Creation, that we are not only naturally led to imitate one another, i. e. have a Disposition to do the same Thing, and assume the same Manners with those with whom we converse, but also have certain natural Dispositions, which incline us to Compassion as well as Imitation. These Things most Men feel, and are sensible of; and therefore need not be proved: The animal Spirits then are not only naturally carried into the respective Parts of the Body to perform the same Actions, and the same Motions which we see others do, but also to receive in some Manner their Wounds, and take Part in their Sufferings.

That Experience tells us, that when we look attentively on any Person severely beaten, or that has a large Wound, Ulcer, or the like; the Spirits immediately flow into those Parts of the Body, which answer to those we see suffer in the other, unless their Course be stopped from some other Principle. This Flux of Spirits is very sensible in Persons of a delicate Constitution, who frequently shudder, and find a kind of Trembling in the Body on these Occasions; and this Sympathy in Bodies produces Compassion in the Mind.

Now it must be observed that the View of the Wound, &c. wounds the Person who views it the more strongly and sensibly, as the Person is more weak and delicate; the Spirits making a stronger Impression in the Fibres of a delicate Body than in those of a robust one. Thus strong, vigorous Men, &c. see an Execution without much Concern, while Women, &c. are struck with Pity and Horror. As to Children still in their Mother's Womb, the Fibres of their Flesh being incomparably finer than those of Women, the Course of the animal Spirits must necessarily produce much greater Alterations.

These Things being laid down, Monsters are easily accounted for. Suppose, e. gr. a Child born a Fool, and with all his Legs and Arms broke in the same Manner as those of Criminals in some Countries are; which Case we chuse to instance in, because such a Monster was born at *Paris*, and lived in one of the Hospitals there twenty Years: The Cause of this Accident, according to the Principles laid down, was, that the Mother seeing a Criminal executed, every Blow given to the poor Man struck forcibly the Imagination of the Woman, and by a kind of Counterstroke, the tender and delicate Brain of the Child. Now, though the Fibres of the Woman's Brain were strongly shaken by the violent Flux of the animal Spirits on this Occasion, yet they had Strength and Consistence enough to prevent an entire Disorder; whereas the Fibres of the Child's Brain being unable to bear the Shock of those Spirits, were quite ruined, and the Ravage was great enough to deprive him of Reason all his Life-time. Again, the View of the

Execu-

Execution frightening the Woman, the violent Course of the animal Spirits was directed forcibly from the Brain to all those Parts of the Body, corresponding to the suffering Parts of the Criminal; and the same Thing must happen in the Child. But in Regard the Bones of the Mother were strong enough to resist the Impulse of those Spirits, they were not damaged, and yet the rapid Course of these Spirits, could easily over-power, and break the tender and delicate Fibres of the Bones of the Child; the Bones being the last Parts of the Body that are formed, and having a very slender Consistence while the Child is yet in the Womb.

To which it may be here added, that had the Mother determin'd the Course of these Spirits towards some other Parts of her Body, by tickling or scratching herself vehemently, the Child would not, in all Probability, have had his Bones broken; but the Part answering that, to which the Motion of the Spirits was determined, would have been the Sufferer.

Hence appears the Reason, why Women in the Time of Gestation, seeing Persons, &c. marked in such a Manner in the Face, impress the same Mark on the same Parts of the Child: And why upon rubbing some hidden Part of the Body, when startled at the Sight of any Thing, or agitated with any extraordinary Passion, the Mark or Impression is fixed on that hidden Part, rather than on the Face of the Child. From the Principle here laid down, may most, if not all the Phænomena of Monsters be easily accounted for.

Among the monstrous Productions of the Sea, the *Mermaid* is that which surprises and puzzles us most.

However Naturalists may doubt of the Reality of *Mermen* or *Mermaids*, we have Testimony enough to establish it. In the Year 1187, as *Larry* informs us, such a Monster was fished up on the Coasts of *Suffolk*, and kept by the Governor for six Months. It bore so near a Conformity with Man, that nothing seemed wanting to it besides Speech. One Day it took the Opportunity of making its Escape, and plunging into the Sea, was never more heard of. *Hist. d'Angleterre*, P. I. p. 403.

In the Year 1430, after a huge Tempest, which broke down the Dykes in *Holland*, and made Way for the Sea into the Meadows, some Girls of the Town of *Edam* in *West-Friesland*, going in a Boat to milk their Cows, perceived a *Mermaid* embarrassed in the Mud, with a very little Water. They took it into their Boat, and brought it with them to *Edam*, dressed it in Women's Apparel, and taught it to spin. It fed like one of them, but could never be brought to offer at Speech. Sometime afterwards it was brought to *Haerlem*, where it lived for some Years, though still shewing an Inclination to the Water. *Purival* relates, that they had given it some Notion of a Deity, and that it made its Reverences very devoutly whenever it passed by a Crucifix.

In the Year 1560, near the Island of *Manar*, on the Western Coast of the Island of *Ceylon*, some Fishermen brought up at one Draught of a Net, seven *Mermen* and *Maids*; of which several Jesuits, and among the rest F. Hen. *Henriquez*, and *Dimas Bosquez*, Physician to the Vice-Roy of *Goa*, were Witnesses. The Physician who examined them with a great deal of Care, and made Dissections thereof, asserts, that all the Parts, both internal and external, were found perfectly conformable to those of Men.

We have another Account well attested of a *Merman*, near the great Rock, called *Diamond*, on the Coast of *Martinico*. The Persons who saw it, gave in a precise Description of it before a Notary. They say that they saw it wipe his Hand over his Face, and even heard it blow its Nose.

Another Creature of the same Species was caught in the *Baltick*, in the Year 1531, and sent as a Present to *Sigismund* King of *Poland*, with whom it lived three Days, and was seen by all the Court. Another very young one was taken near *Rocca de Sintra*, as related by *Damian Goes*.

The King of *Portugal*, and the Grand Master of the Order of *St. James*, are said to have had a Suit at Law to

determine which Party these Monsters belonged to.

Note, That as Naturalists doubt much of the Existence of *Mermaids* and *Mermen*, they have took no Pains to account for them; therefore we are at a Loss to know how they live, and are propagated in the Sea; for if it be true what the *Portuguese* Physician says, that in the Dissection he made of those Sea-Monsters, he found all their Parts both internal and external, perfectly conformable to those of Men, he should have informed us likewise, how those Creatures can breathe in the Sea, if they have the Organs of Respiration like ours; since it is impossible they should dwell long under Water, without being suffocated; which is one of the strongest Reasons Naturalists have for denying the Existence of those Monsters.

Note also, That from the Description of Monsters, I'll pass to what appears the most capable to flatter our Curiosity, in the Animal, Vegetable, and Mineral Worlds. Beginning by the Animal World; and in that by the *Unicorn*.

The *UNICORN*, is an Animal famous among the *Greek* Authors under the Name of *μονοκερως*; and among the *Latins* under that of *Unicornu*, both these Names he takes from its distinguishing Characteristick, the having one Horn only; which is represented as five Palms long, growing in the Middle of the Forehead.

This Animal claims a Place here, not only as it makes a curious Article in *Natural History*, but also as it furnishes something to Medicine, Commerce, and Heraldry.

The popular Account is, that it is about the Size of a Horse, its Hair short, and of a dark-brown Colour; very timorous, and therefore keeping mostly in the Woods; and that its true Place is the Province of *Agoas*, in the Kingdom of *Damotes* in *Ethiopia*.

The first Author who wrote of the *Unicorn*, was one *Cresius*, whom *Aristotle* mentions as a very suspicious Author; *Ælian* only speaks of him in very doubtful Terms. The other Writers on the Subject are *Philostratus* and *Solinus*; *Æneas Sylvius*, who is Pope *Pius II.* *Marcus Paulus*, *Alcosius*, *Gesner*, *Garcia ab horto*, *And. Marinus*, &c. of these some say it resembles a Horse, others an Ass, others a Goat by its Beard; others an Elephant, others a Rhinoceros, others a Grey-hound, &c.

Munster and *Thevet* will have it an amphibious Animal, and its Horn to be moveable at Pleasure. Others make all its Strength to consist in its Horn; and add that when pursued by the Hunters, it precipitates itself from the Top of the highest Rocks, and pitches upon its Horn; which sustains the whole Effort of its Fall, so that it receives no Damage thereby. In Effect, the several Authors do all give several Accounts of the Figure and Colour, both of the Animal, and of its Horn, and all its Parts. And hence the more knowing among the Moderns, do unanimously hold it a fabulous Animal.

The Legend adds, that it is wonderful fond of chaste Persons, and therefore, in order to take it, a Virgin is placed in its Way; whom, when the *Unicorn* spies, he lies down by her, and lays his Head on her Lap, and so falls asleep; upon which the Virgin making a Signal, the Hunters come in and take the Beast; which could never be caught any other Way, because it would either cast itself headlong from a Rock, or die.

What ordinarily passes among us for *Unicorn's Horn*, and is shewn for such in the Collections of Curiolities, and used for such by several Physicians, we are assured by *Pereyra*, in his Account of *Greenland*, is the Tooth of a large Fish of the Whale-Kind, called by the Islanders *Narwal*; and in other Places *Walrus* and *Robart*, frequent enough in the Icy Sea. This Tooth or Horn, turned, channelled, and terminating in a Point, as it is, springs out of the Middle of the Fore-part of the upper Jaw, and serves it as a Weapon of Defence, wherewith it dares to attack the largest Whale. It can strike it with such Violence, as even to pierce the Side of a strong built Ship.

Note, That the Horn of the *Narwal* caught in 1736, in a Creek of the *Elbe*, in the Dutchy of *Bremen*, and, as Dr. *Hampe* assures us, from the Fore-part of the Head, just above the Mouth, and was six Foot long, white like Ivory, and curiously twisted. Yet *Hæmmon*, and

and the Generality of Authors, take it for a Tooth. Many hold its chief Use is to break the Ice. Dr. *Steigarthal* rather imagines it to serve to seek its Food; and mentions a Whale caught in *Greenland*, in the Belly of which a *Narwal* had stuck its Tooth close to the Mouth, and had sucked the Blood and Humours.

There is a fine Horn of this Kind preserved in the Repository of St. Denis at *Paris*, given by *Andr. Thevet*, and pretended to have been a Present to him from the King of *Monomotapa*, who carried him to hunt the Unicorn; which is frequent in that Country. This Horn some have suspected to be an Elephant's Tooth, carved in that Manner. At *Straßbourg* there is another between seven and eight Feet long. In the Repository at *Venice*, there is a good Number; all different from each other.

The Antients held the Unicorn's Horn to be a Counter-Poison; and that the Animal used to dip it in the Water, to purify and sweeten it ere it would drink. It is added, that for the same Reason other Beasts wait to see it drink before them. Thence, as also from the Rarity of the Thing, People have taken Occasion to attribute divers medicinal Virtues thereto.

But *Amb. Paré* has proved it a mere Piece of Charlatanery, and all the Virtues attributed to it to be false; and yet the Price it has bore, is almost incredible: *Andrea Racci*, a Physician of *Florence*, affirms the Pound of 16 Ounces to have been sold in the Apothecaries Shops, for 1536 Crowns, when the same Weight of Gold was only worth 148 Crowns.

Among the feather'd Society, the PHENIX was a Bird famous among the Antients; but generally look'd upon by the Moderns as fabulous.

The Naturalists speak of it as single, or the only one of its Kind: They describe it as of the Size of an Eagle; its Head finely crested with a beautiful Plumage. Its Neck cover'd with Feathers of a Gold Colour, and the rest of its Body Purple, only the Tail white, intermixed with Carnation; and its Eyes sparkling like Stars. They hold that it lives five or six hundred Years in the Wilderness: That when thus advanced in Age, it builds itself a Funeral Pile of Wood and aromattick Gums; then it lights it with the Wafting of its Wings, and thus burns itself; and from its Ashes arises a Worm, which in Time grows up to be a *Phoenix*.

Hence the *Phenicians* gave the Name *Phoenix* to the Palm-Tree, by Reason when burnt down to the very Root, it rises again fairer than ever.

In the Sea we find the TORPEDO, which is a Fish famed both among the antient and modern Naturalists, for a remarkable Numbness wherewith it strikes the Arm of such as touch it.

Various are the Accounts given us of this singular Fish; some Authors raising the Effects it produces to a Kind of Miracle; and others treating them a little better than Chimera's; some solving the Appearance this Way, and some that. But *M. Reaumur*, of the *French Academy of Sciences*, has at length cleared the Point, and set the Matter in a satisfactory Light.

The *Torpedo* is a flat Fish, much of the Figure of the Thorn-back, sufficiently described in most Treatises of Fishes, and commonly enough found about the Coasts of *Provence*, *Gascony*, &c. where the People eat it without any Danger.

Upon touching the *Torpedo* with the Finger, it frequently, though not always happens, that the Person feels an unusual painful Numbness, which suddenly seizes the Arm up to the Elbow, and sometimes to the very Shoulder and Head.

The Pain is of a very particular Species, and not to be described by any Words; yet Messrs. *Lorenzini*, *Borelli*, *Redi*, and *Reaumur*, who all felt it severely, observe it to bear some Resemblance to that painful Sensation felt in the Arm, upon striking the Elbow violently against a hard Body; though *M. Reaumur* assures us, this gives but a very faint Idea of it.

Its chief Force is at the Instant it begins; it lasts but a few Moments, and then vanishes entirely. If a Man do not actually touch the *Torpedo*; how near soever he holds his Hand, he feels nothing: If he touches it with a Stick, he feels a faint Effect: If he touches it through the Interposition of any pretty thin Body, the Numbness is felt

very considerably: If the Hand be pressed very strong against it, the Numbness is the less, but still strong enough to oblige a Man speedily to let go.

There are different Ways of accounting for this Effect: The first is that of the Antients, who contented themselves with ascribing a torporifick Virtue or Faculty to this Animal.

The second will have the Effect produced by the *Torpedo*, to depend on an infinite Number of Corpuscles, issuing continually out of the Fish, but more copiously under some Circumstances than others: This is the Opinion most generally received; being adopted by *Redi*, *Perrault*, and *Lorenzini*.

They explain themselves thus: As the Fire unites a Quantity of Corpuscles proper to heat us, so the *Torpedo* unites a Quantity of Corpuscles for to numb the Part they insinuate themselves into; whether it be by their entering in too great Abundance, or by the falling into Tracts or Passages, very disproportionate to their Figures.

The third Account is that of *Borelli*, who looks on this Emission of Corpuscles, as imaginary: He says, that upon touching the Fish, it puts itself into a violent Tremor or Agitation, and that this occasions a painful Numbness in the Hand that touches it. But *M. Reaumur* assures us, that notwithstanding all the Attention he could view this Fish withal, when ready to strike the Numbness, he could perceive nothing of this Trembling or Agitation.

The last and most just Hypothesis, is that of *M. Reaumur*. The *Torpedo*, like other flat Fish, he observes, is not absolutely flat, but its Back, or rather all the upper Part of its Body, a little Convex: When it did not, or would not produce any Numbness, in such as touched it, its Back he found always preserved its natural Convexity; but whenever it would dispose itself to receive a Touch or Thrust, it gradually diminished the Convexity of the back Parts of the Body; sometimes only rendering them flat, and sometimes even Concave.

The very next Moment, the Numbness always began to seize the Arm; the Fingers that touched, were obliged to give back, and all the flat and concave Part of the Body was again seen Convex; and whereas it only became flat insensibly, it returned to its Convexity so swiftly, that one could not perceive any Passage from the one to the other State.

The Motion of a Ball out of a Musket, is not perhaps much quicker, than that of the Fish reassuming its former Situation; at least the one is not more perceivable than the other.

It is from this sudden Stroke, that the Numbness of the Arm arises; and accordingly, the Person when he begins to feel it, imagines that his Fingers have been violently struck. It is the mere Velocity of the Stroke that produces the Numbness.

The Wonder is, how so soft a Substance, as that of the Fish, should give so rude a Blow: Indeed a single Stroke of a soft Body could never have done it; but in this Case there is an Infinity of such Strokes given in an Instant. To explain the admirable Mechanism hereof, we must give a View of the Parts whereon it depends.

This Mechanism then consists in two very singular Muscles, described by several Authors, who have given the Anatomy of the *Torpedo*; *Redi*, and after him *Lorenzini*, call them the *Musculi Falcati*; their Form is that of Crescents, and they together take up almost half the Back of the Fish, the one on the right Side, and the other on the Left. Their Origin is a little above the Mouth, and they are separated from each other by the Brunchia, into the last of which they have their Insertion.

What is singular in them is their Fibres, if with the Authors abovementioned, we may give that Name to a Sort of smaller Muscles as big as Goose-quills, of an Assemblage whereof the two great Muscles are formed. These lesser Muscles are hollow Cylinders, their Length nearly equal to the Thickness of the Fish, and ranged aside of each other, all perpendicular to the upper and lower Surfaces of the Fish, accounting their Surfaces as two nearly parallel Planes. The exterior Surface of each of these Cylinders consists of whitish Fibres, whose Direction is the same

with that of the Cylinder; but these Fibres only form a Kind of Tube, whose Particles are not above the Thickness of a Leaf of Paper. The Cavity of the Tube is full of a soft Matter, of the Colour and Consistence of Pap, divided into twenty-five or thirty different little Masses, by so many Partitions, parallel to the Base of the Cylinder, which Partitions are formed of transverse Fibres; so that the whole Cylinder is in some measure composed of twenty-five or thirty smaller Cylinders placed over each other, and each full of a medullary Substance.

We need only now remember, that when the *Torpedo* is ready to strike its Numbness, it slowly flattens the outer Surface of its upper Part, and the whole Mechanism whereon its Force depends will be apparent. By that gradual Contraction it binds as it were all its Springs, renders all its Cylinders shorter, and at the same Time augments their Bases, or which amounts to the same, stretches all the little Inclosures which divide the soft Matter. In all Probability too, the large Fibres, or little Muscles, in that Moment, lose their cylindrical Form to fill the Vacuities between them.

The Contraction being made to a certain Degree, all the Springs unbend, the longitudinal Fibres are lengthened, the transverse ones, or those which form the Inclosures are shortened; each Inclosure drawn by the longitudinal Fibres which are lengthened, drives the soft Matter it contains upwards, in which it is apparently assisted by the undulatory Motion, which is in the transverse Fibres when contracting.

If then a Finger touch the *Torpedo*, it presently receives a Stroke, or rather several successive Strokes, from each of the Cylinders whereon it is applied. As the soft Matter is distributed into divers Inclosures, it is more than probable, all the Strokes are not given precisely at the same Moment; nay, were there no Inclosures to separate the Matter, its Impression would give Strokes, in some measure, successive, for all Parts of soft Bodies do not strike at once; the Impression of the last does not take, till after the first have done acting. But these several Inclosures serve to augment the Number of the Springs, and of Consequence the Velocity and Force of the Action.

These quick reiterated Strokes given by a softish Matter, shake the Nerves, suspend or change the Course of the animal Spirits, or some fluid Equivalent; or, if you had rather these Strokes produce an undulatory Motion in the Fibres of the Nerves, which clashes or disagrees with that they should have, in order to move the Arm. And hence the Inability we are under of using the same, and the painful Sensation which accompanies it.

Hence it is that the *Torpedo* does not convey its Numbness to any Degree, except when touched on this great Muscle; so that the Fish is very safely taken by the Tail, which is the Part by which the Fishermen catch it.

The Authors who have accounted for the Effect of the *Torpedo* from Torporifick Effluvia, have been obliged to have Recourse to the same two Muscles; but then they only make them Reservoirs of the Corpuscles, whereby the Numbness is effected.

Lorenzini, who has observed the Contraction as well as *Reaumur*, pretends, that all its Use is to express all those Corpuscles from out of the hollow Fibres of these Muscles wherein they are imprisoned; but this Emanation of Corpuscles admitted by most Authors, is disproved by *M. Reaumur*, from the following Considerations.

1. In that no Numbness is conveyed, if the Hand be at the smallest Distance from the *Torpedo*; now, to use their own Comparison, if the *Torpedo* numbs as the Fire warms, the Hands would be affected at a Distance from one as well as the other.

2. In that the Numbness is not felt till the Contraction of the Muscles is over, whereas were the Cause in torporifick Particles, it would be conveyed by Degrees, as the Hand warms by Degrees. Lastly, in that the *Torpedo* conveys its Numbness to the Hand, through a hard solid Body, but does not do it through the Air.

Were the only Use the *Torpedo* makes of its Faculty, the saving itself from the Fishermen, as some have supposed, it would signify but little; for it is very rare that it escapes their Hands.

Pliny, *Aristotle*, and most Naturalists therefore agree, that it likewise serves it for the catching of other Fishes; all we know for certain is, that it lives on other Fishes, and that it is generally found on Banks of Sand, &c. exerting its Faculty.

M. Reaumur had no Fishes alive to examine what the *Torpedo* would do to them; but an Animal next a-kind to a Fish he tried it on, viz. a Drake, which being shut up awhile in Water with the Fish, was taken out dead, doubtless from its too frequent Contacts on the *Torpedo*.

In the History of *Abyssinia* we are assured, that if the *Torpedo* kill living Fishes, it seems to bring dead ones to Life again; dead Fishes being seen to stir if put in the same Vessel with it; but this is much less credible than what is told us in the same History, that the *Abyssinians* use *Torpedo's* for the Cure of Fevers, by tying down the Patient to a Table, and applying the Fish successively upon all his Members, which puts him to a cruel Torment, but effectually rids him of his Disease.

Bellonius assures us, that our own *Torpedo's* applied to the Soles of the Feet, have prov'd successful against Fevers.

M. du Hamel, in his History of the Academy of Sciences, *An. 1677*, mentions a Kind of *Torpedo's*, which he compares to Conger Eels: *M. Richer*, from whom he has the Account, affirms, on his Knowledge, that they numb the Arm strongly, when touched with a Staff, and that their Effect even go to the giving Venigo's.

Note, That from the animal, I'll pass into the vegetable World, and there take a particular Notice of the *Gin-seng*.

The *GIN-SENG*, or *GIN-SEM*, or *GINZENG*, is a very extraordinary and wonderful Plant, hitherto only found in *Tartary*.

The *Gin-seng* is one of the principal Curiosities of the *Chinese* and *Tartars*; their most eminent Physicians have wrote many a Volume of its Virtues.

It is known among them by divers other Names, as the *only spirituous*, the *pure Spirit of the Earth*, the *Plant that gives Immortality*, &c. It makes in Effect, the whole *Materia Medica* for the People of Condition, being too precious for the Populace.

All the Writers of the *Chinese* Affairs make mention of the *Gin-seng*, as *Martinius* in his *Atlas*; *F. Kircher*, in his *China illustrata*; *F. Tachard* in his *Voyages*; and *F. le Comte* in his *Memoirs*.

And yet we knew very little of this Plant, before *F. Jartoux* a Jesuit, and Missionary in *China*, who being employed by Order of the Emperor in making a Map of *Tartary*, in the Year 1709, had an Opportunity of seeing it growing in a Village, about four Leagues from the Kingdom of *Corea*, inhabited by *Tartars*, called *Calca-Tatze*.

That Father took the Opportunity to make a Draught of the Plant, and hath given an accurate Description thereof, with its Virtues, and the Manner of preparing it, which, being a great Curiosity, we shall here gratify the Reader withal.

The *Gin-seng*, has a white Root somewhat knotty, about thrice the Thickness of the Stem, and which goes tapering to the End: At a few Inches from the Head it frequently parts into two Branches, which gives it some Resemblance of a Man, whose Thighs the Branches represent; and it is hence it takes the Denomination *Gin-seng*.

From the Root rises a perfectly smooth and tolerable round Stem; its Colour is a pretty deep Red, except towards the Foot, where, by the Neighbourhood of the Earth, it is turned somewhat whiter. At the Top of the Stem is a Sort of Joint or Knot, formed by the shooting of four Branches, which spread as from a Centre: The Underside of each Branch is green mixed with white, and the upper Part much like the Stalk, of a deep Red; the two Colours gradually decrease, and at length unite on the Sides.

Each Branch has five Leaves; and it is observable, that the Branches divide equally from each other, both in respect of themselves, and of the Horizon; and with the Leaves make a circular Figure nearly parallel to the Surface of the Ground.

The Fibres of the Leaves are very distinguishable, and on the upper Side are beset with small whitish Hairs; the Membranes or Pellicles between the Fibres rise a little in the Middle, above the Level of the Fibres.

The Colour of the Leaf is a dark Green above, and a shining whitish Green underneath, and all the Leaves are finely jagged or indented.

On the Edges, from the Center of the Branches, arises a second Stalk, very strait, smooth, and whitish, from Bottom to Top, bearing a Bunch of round Fruit, of a beautiful red Colour. This Bunch, in the Plant viewed by our Missionary, was composed of twenty-four Berries.

The red Skin that covers the Berries is very thin and smooth, and contains within it a white Pulp: As these Berries were double (for they are sometimes single) each had two rough Stones, of the Size and Figure of our Lentils. The Pedicles whereon the Berries were supported, all arose from the same Center, and spreading exactly like the Radii of a Sphere, made the Bunch of Berries of a circular Form. The Fruit is not good to eat, and the Stone includes a Kernel; it has also a small Beard at the Top, diametrically opposite to the Pedicle.

The Plant dies away every Year, the Number of its Years may be known by the Number of Stalks it has shot forth, of which there always remains some Mark.

As to the Flower, F. *Jartoux* owns he had never seen it, and therefore could not describe it: Some have assured him that it is white, and very small; others, that there is no Flower at all, and that no body had ever seen it. He rather inclines to think it so small, as to have escaped Notice; and, what confirms him in the Opinion, is, that those who seek the *Gin-seng*, having nothing in View but its Root, overlook and despise the rest as useless.

As they have sowed the Seed in vain, without any Plant ever arising therefrom, it is probable this might give Occasion to the Fable which is current among the *Jartoux*. They say, that a Bird eats it as soon as in the Earth; and not being able to digest it, it putrifies in its Stomach, and afterwards springs up in the Place where it was cast by the Bird with its Dung. The Missionary rather believes, that the Stone remains a long Time in the Ground before it takes Root, which Opinion appears the more probable, as there were some Roots no longer or bigger than one's little Finger, which yet have shot forth, at least ten Stalks.

Though the Plant here described had four Branches, yet there are some which have but two, others three, and others five, six, or seven; but each Branch has always five Leaves.

The Height of the Plant is proportionable to its Bigness; and the Number of Branches that the Root has, the larger and more uniform it is; and the fewer small Strings or Fibres it has, the better it is accounted.

It is hard to say why the *Chinese* should call it *Gin-seng*, a Word which signifies Figure, or Representation: Neither that Father, nor any he inquired of, could ever find that it bore more Resemblance to the Figure of a Man, than is ordinarily seen among other Roots. The *Tartars*, with more Reason, call it *Orbota*, that is, the first of Plants.

Those who gather the *Gin-seng*, preserve only the Root, and all they can get of it in ten or fifteen Days Time, they bury together in some Place under Ground. Then they take Care to wash it well, and scour it with a Brush; then dip it in scalding Water, and prepare it in the Fumes of yellow Millet, which gives it Part of its Colour.

The Millet is put in a Vessel with a little Water, and boiled over a gentle Fire; the Roots are laid over the Vessel upon small transverse Pieces of Wood, being first covered with a Linnen Cloth, or some other Vessel, placed over them.

They may also be dried in the Sun, or by the Fire; but then, though they retain their Virtue well enough, they have not that yellow Colour, which the *Chinese* so much admire. When the Roots are dried, they must be kept close in some very dry Place, otherwise they are in Danger of Corruption, or being eaten by Worms.

As to the Place where this Root grows, it is between

the 39th and 47th Degree of North Latitude; and between the 10th and 20th Degree of East Longitude, reckoning from the Meridian of *Pekin*. Here is found a long Tract of Mountains, which the thick Forests that cover and encompass them, render almost impassable. It is upon the Declivities of these Mountains, and in these thick Forests, upon the Banks of Torrents, or about the Roots of Trees, and amidst a thousand other different Sorts of Plants, that the *Gin-seng* is found. It is not to be met with in Plains, Vallies, Marshes, the Bottom of Rivulets, or in Places too much exposed and open.

If the Forest takes Fire and be consumed, this Plant does not appear till two or three Years after; it also lies hid from the Sun as much as possible, which shews that Heat is an Enemy to it.

The Places where the *Gin-seng* grows, are on every Side separated from the Province of *Quan-tong*, by a Barrier of wooden Stakes, which encompasses this whole Province, and about which Guards continually patrol, to hinder the *Chinese* from going out and looking after this Root.

Yet how vigilant soever they are, Greediness after Gain incites the *Chinese* to lurk about privately in these Desarts, sometimes to the Number of two or three Thousand, at the Hazard of losing their Liberty, and all the Fruits of their Labour, if they were taken, either as they go out, or come into the Province.

The Emperor having a Mind that the *Tartars* should reap all the Advantage that is to be made of this Plant, rather than the *Chinese*, gave Orders in 1709, to ten thousand *Tartars* to go and gather all that they could of the *Gin-seng*, upon Condition that each Person should give him two Ounces of the best, and that the rest should be paid for, weight for weight in pure Silver.

It was computed, that by this Means the Emperor would get this Year about twenty Thousand *Chinese* Pounds of it, which would not cost him above one fourth Part of its Value.

We met by Chance, says F. *Jartoux*, with some of these *Tartars*, in the Midst of those frightful Desarts; and their *Mandarins*, who were not far out of our Way, came one after another, and offer'd us Oxen for our Subsistence, according to the Commands they had received from the Emperor.

This Army of *Herbarists* observed the following Order: After they had divided a certain Tract of Land among their several Companies, each to the Number of a hundred Persons, spread itself out in a right Line, to a certain fixed Place; every ten of them keeping at a Distance from the rest.

Then they searched carefully for the Plant, going on leisurely in the same Order; and in this Manner, in a certain Number of Days, they run over the whole Space of Ground appointed them.

When the Time is expired, the *Mandarins*, who are encamped with their Tents in such Places as are proper for the Subsistence of their Horses, send to view each Troop, to give them fresh Orders, and to inform themselves if their Number is compleat.

If any one of them is wanting, as it often happens, either by wandering out of the Way, or being attacked by wild Beasts, they look for him a Day or two, and then return again to their Labour as before.

The *Gin-seng*, we have observ'd, is an Ingredient in most of the Medicines which the *Chinese* Physicians prescribe to the better Sort of Patients: They affirm, that it is a sovereign Remedy for all Weaknesses occasioned by excessive Fatigues, either of Body or Mind: That it attenuates and carries off pituitous Humours; cures Weakness of the Lungs, and the Pleurisy; stops Vomiting; strengthens the Stomach; and helps the Appetite; disperses Fumes or Vapours; fortifies the Breast; is a Remedy for short and weak Breathing; strengthens the vital Spirits; and is good against Dizziness of the Head, and Dimness of Sight; and that it prolongs Life to extreme old Age. No Body can imagine, that the *Chinese* and *Tartars* would set so high a Value upon this Root, if it did not constantly produce a good Effect: Those that are in Health, often make use of it to render themselves more vigorous and strong; and I am persuaded, adds the Father just mentioned, it would prove an

an excellent Medicine in the Hands of any *European* who understands Pharmacy, if he had but a sufficient Quantity of it to make such Trials as are necessary to examine the Nature of it chymically, and to apply it in a proper Quantity, according to the Nature of the Disease for which it may be beneficial.

It is certain, that it subtilizes, increases the Motion of, and warms the Blood; that it helps Digestion, and invigorates in a very sensible Manner.

After I had design'd the Root (he goes on) I observed the State of my Pulse, and then took half of the Root, raw as it was, and unprepar'd; in an Hour after, I found my Pulse much fuller and quicker: I had an Appetite, and perceived myself much more vigorous, and could bear Labour better and easier than before. Four Days after finding myself so fatigued and weary, that I could scarce sit on Horseback, a *Mandarin* who was in Company with us, perceiving it, gave me one of these Roots: I took half of it immediately; and an Hour after I was not in the least sensible of any Weariness.

I have often made Use of it since, and always with the same Success. I have observed also, that the green Leaves, and especially the fibrous Part of them, chew'd, would produce nearly the same Effect. The *Tartars* often bring us the Leaves of *Gin-feng* instead of Tea; and I always find myself so well afterwards, that I should readily prefer them before the best Tea. Their Decoction is of a grateful Colour; and after taking it twice or thrice, its Taste and Smell becomes very agreeable.

As for the Root, it is necessary to boil it a little more than Tea; as is practised by the *Chinese*, when they give it to sick Persons. On which Occasion they seldom use more than the fifth Part of an Ounce of the dried Root.

To prepare the Root for Exhibition, cut it into thin Slices, and put it into an earthen Pot well glazed, with about half a Pint of Water; the Pot to be well cover'd, and set to boil over a gentle Fire; and when the Water is consumed to the Quantity of a Cup-full, a little Sugar to be mixed with it, and to be drank: Immediately after this, as much more Water to be put on the Remainder, and to be boiled as before, to extract all the Juice, and what remains of the spirituous Part of the Root. These two Doses to be taken, the one in the Morning, and the other in the Evening.

A Tree grows, likewise, in *China*, *Lao*, and *Cochinchina*, called the *Aloes-Tree*, which is much about the Size and Figure of our Olive-Trees. The Trunk consists of three Sorts of Wood, very different in Colour and Properties. Immediately under the Bark, it is black, compact and heavy, called by the *Portuguese*, *Pao d'Aquilo*, q. d. Eagle-Wood. The next under this is of a Tan-Colour, light and veiny, resembling rotten Wood; and called *Calambo*.

The Heart or innermost Part is called *Tamback*; and more valued by the *Indians* than Gold itself. It affords a very strong, but agreeable Smell; and is used as a Perfume; and is withal held a sovereign Remedy against the Palsy, Deliquium, Weakness, &c.

It is the *Calambo* alone which is known among us. It is brought in small Bits of a very fragrant Scent; especially when cast on the Fire, where it melts like Wax. The best is of a blackish purple Colour, and so light as to swim on Water: It is hot and drying; and esteemed a great Strengtheners of the Nerves.

Note, That the *Aloes-Wood* is infinitely valued; and divers strange Fables have been invented as to the Origin of the Tree which yields it; some feign that it grew in Paradise, and was only conveyed to us by Means of the Rivers overflowing their Banks, and sweeping off the Trees in their Ways. Others suppose it to grow on inaccessible Mountains; where it is guarded by certain wild Beasts, &c. The *Siamese* Ambassadors to the Court of *France*, in 1686, who brought a Present of this Wood from their Emperor, first gave the *Europeans* any consistent Account of it.

In the *West-Indies*, particularly in the Provinces of *Guanimala*, and *Nicaragua*, and the *Caribbee* Islands, grows a Tree, resembling our Cherry-Tree, which pro-

duces a Kind of Nut about the Size of an Almond, called *CACAO*, or *COCOA*.

The native *Mexicans* called the *Cacao-Tree*, *Cucubaa*, *Guabuets*; it is so very delicate, and the Soil it grows in so hot, that to guard it from the Sun, they always plant it in the Shade of another Tree, called *Mother of Cacao*.

The Fruit is enclosed in a Kind of Pod, of the Size and Figure of a Cucumber; except that it begins, and ends in a Point. Within the Pod, which is half a Finger thick, is formed a Tissue of white Fibres, very succulent, a little acid, and proper to appease Thirst. In the Middle of these Fibres are contained 10, sometimes 12, and sometimes more, as far as 40 Grains or Seeds, of a Violet Colour, and dry as Acorns. Each Grain, which is covered with a little Bark or Rind, when stripped thereof, separates into five or six unequal Pieces, in the Middle whereof is a Kernel or Pippin, having a tender Bud, very difficult to preserve.

Of this Seed, with the Addition of *Vanilla*, and some other Ingredients, the *Spaniards*, and after their Example, the rest of *Europe*, prepare a Kind of Conserve or Cake; which diluted in hot Water, makes that delicious wholesome Drink, called Chocolate.

This precious Fruit, the *Spaniards* make so considerable a Trade of, that there are some who make 5000 *l.* Sterling, *per Annum*, from a single Garden of *Cacao's*. There are two Kinds of *Cacao's*, the most common, which is likewise the best, is of a dark Colour, bordering on red, and round; the other called *Patlas*, is white, larger, thicker, and flatter. Its Quality is desiccative. Some Druggists, however, sell four Kinds, *viz.* the great and little *Caracca*, and the great and little *Cacao* of the Islands. Which may be probably reduced to the two Kinds above-mentioned. It being only the greatest and smallest that multiplies the Names and Kinds.

The *Cacao* Nuts are esteemed by the *Mexicans* as *Anodyne*; and used, eaten raw, to assuage Pains of the Bowels. They also procure a Kind of Butter or Oil from them, as sweet as that of Almonds, and drawn in the same Manner, excellent for Burns.

In some Parts of *America*, the *Cacao* Grains are used by the *Indians* as Money; twelve or fourteen are esteemed equivalent to a *Spanish* Real, or Six-pence three Farthings Sterling.

From this I'll pass to *Fossils*, &c. and examine first the *Glossopetra*, which is a Kind of Stone, in Form of a Serpent's Tongue, commonly found in the Island of *Malta*, and divers other Parts.

Naturalists are divided as to the Nature and Origin of these Stones. — *Steno*, *De corpore solido intra solidum contento*. *Ol. Womfius*, *Dissert. de Glossopetra*; and *Reyfishius*, *De Glossopetris Lunenburgensibus*, treat of them at large.

The vulgar Opinion is, that they are the Tongues of Serpents petrified; and hence their Name, which is a Compound of *γλωσσα*, Tongue, and *πίτρα*, Stone. Hence also their pretended extraordinary Virtue in curing the Bites of Serpents.

The People relate, that since the Viper which bit *St. Paul* without doing him any Harm, all the Serpents of the Island of *Malta* have had the same Virtue; and that the *Glossopetra* are the Tongues of those formerly dead. But this is a palpable Fable, which the sole Figure of the *Glossopetra* refutes; they having nothing of the Figure of a Serpent; besides that they are too big.

The common Opinion of Naturalists is, that they are the Teeth of Fishes, left at Land by the Waters of the Deluge; and since petrified. Some specify the very Kind of Fish; and take it to be that which *Theophrastus*, and the *Greek* Authors call *καρχαρις*; and the Moderns the *Shark*, or *Sea-Dog*.

Camerarius cannot persuade himself, that the *Glossopetra* found in *England*, *Malta*, and a-round *Montpelier*, were ever the Teeth of a Sea-Dog or any other Fish. The chief Difficulty he suggests, is the small Quantity of volatile Salt, and Oil they afford by Distillation. To which *Dr. Woodward* answers, in Defence of the common ridiculous System, that having laid so long buried under Ground, 'tis no Wonder they should have lost the best part

Part of their volatile Principles. Those who espouse this common System, and pretend to defend it, say, that it is certain then human Bones and Skulls long interred, do not afford near the Quantity of those Principles, as they would have done immediately after the Person's Death.

Another Scruple proposed by *Camerarius* is, that the *Glossopetra*, when exposed to the naked Fire, turns to a Coal, and not to a Calx; contrary to what is asserted by *Fabius Columna*. Dr. *Woodward* answers, that it is likely enough the *Glossopetra*, in burning, may assume the Form of Coal, before it arrives at that of a Calx.

SHELLS are also one of the chief Objects of *Natural History*; though Naturalists have been generally mistaken, as to the Manner of the Formation of *Shells*.

The Animal and its *Shell* (which is a hard Crust, serving to cover and inclose it) have been always supposed to arise from the same Egg. But M. *Reaumur* has shewn the Supposition to be false. He has found by certain Experiments, that the *Shells* of Garden Snails are formed of a Matter which perspires from their Bodies, and hardens and condenses in the Air.

It is certain, that all Animals perspire, and are encompassed with a Kind of Cloud or Atmosphere; which exhales from them; and in all Probability, assumes pretty nearly their external Figure. Snails have nothing peculiar in this Respect, unless that the Atmosphere of their Perspiration, condenses and hardens about them, and forms a visible Cover, whereof the Body is the Mould or Model; whereas that of other Animals is evaporated and lost in the Air. This Difference arises from the different Substance perspired; that coming from Snails is viscous and stony. This is no Supposition; but a Matter of Fact, which M. *Reaumur* has well proved by Experiments.

On this Principle, though the Shell serves the Animal as an universal Bone, yet it does not grow like a Bone, nor like any of the other Parts, by Vegetation; that is, by a Juice circulating within itself; but by an external Addition of Parts laid one over another; as is commonly supposed of Stones.

But to consider the Thing more particularly; it is to be remember'd, that the Snail's Head is always at the Aperture of the Shell, and its Tail in the Tip or Point of the Shell; and that its Body is naturally turned into a spiral Form, the different Spires or Circumvolutions whereof are in different Planes. This supposed; take the Snail just hatched; as the Matter it perspires petrifies around it, there must be first formed a little Cover, proportion'd to the Bigness of its Body; and as its Body is yet too little to make a Circumvolution of a Spiral, at least a whole one; this Cover will only be the Centre, or at most the beginning of a little Circle of a Spiral. But the Animal grows; if then it ceased to perspire, it is evident, all that is added to its Body, would remain naked; but as it continues to perspire, it makes itself a Cover in Proportion as it needs it. Thus is an entire Circumvolution of a Spiral formed; and thus is a Second and Third; and still every new Spire is bigger than the last; in regard the Animal grows in Thickness, at the same Time as it grows in Length. When the Animal ceases to grow, yet it does not cease to perspire, accordingly the Shell continues to grow thicker, though not longer.

SHELLS, *Conche*, or *Cochleæ*, make a considerable Article in the Cabinet of the Curious: The finest and rarest are these that follow, viz. the *Papal Crown*, *Tiaræ Pontificæ*, which takes its Name from its Form, and which is all streaked with red on a white Ground. The *Feather*, *Pluma*, whose Whiteness, with its Carnation Stains, have an admirable Effect. The *Hebraica*, which on a Ground as white as Snow, has Spots as black as Jet, much resembling *Hebrew* Characters. The *Chinese Snail*, *Limax Sinicus*, which has a green and black Embroidery, on a dark brown Ground. The *Cloth of Gold*, *Textile Aureum*, remarkable for an admirable Tissue of yellow, brown, and black. The *Cloth of Silver*, *Textile Argentum*, which does not come behind that of Gold in Beauty. The *Leopard*, *Pardus*, which is all speckled. The *Tyger*, *Tigris*, seu *Concha Cirenica*, whose Spots exceed those of the Leopard. The *Hart's Horn*, *Cornu Cervinum*, which has black Stains on a white Ground.

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The *Purse*, *Crumena*, thus called from its Figure; it is embroidered with three or four Colours. The *Sun-Dial*, *Solarium Manuarium*. The *Caterpillar*, *Cruca*, both denominated from their Forms. Add the *Nerites*, *Nautilus*, *Lepas*, *Lepasia*, *Apporays*, *Tuba*, *Galea*, &c.

In *Aldovrand*, *Gesner*, and *Fabius Columna*, we have all that the Antients have said on the Subject of *Shells*. In 1692, Dr. *Lister* published a *Natural History* of *Shells* in Folio, full of Cuts, representing the various Kinds of *Shells*. Under the first Class he ranges the terrestrial or Land *Shells*; in the second, the fresh Water *Shells*, both those called *Turbinata*, and those *Bivalvia* and *Multivalvia*: And in the fourth he divides into several Classes, the Sea *Shells*, called *Turbinata*. The *turbinated* are those which are spiral, or wreathed, conically, from a larger Basis to a Kind of Apex. *Bivalve*, is a Term used for such Shell-Fish, as have two Shells, e. gr. Cockles, Muscles, Oysters, &c. which are said to be of the *bivalvular* Kind. A *Bivalve Shell* being a large Blood-red Spondile in *Buco's* Cabinet, is said by Dr. *Lister* to have been purchased by the Duke of Orleans for 900 Livres, which is upwards of 50 l. Sterling. The same Prince offer'd a *Parisian* 11000 Livres for 32 *Shells*, and was refused.

Shells, are frequently found under Ground, in Places far remote from the Sea, in Mines, and even on the Tops of Mountains: But how they should come there; is a Thing the Naturalists are greatly divided about. The most easy and common Opinion is, that those Parts have been formerly Sea, or at least have been overflowed thereby; and many even go as high as the grand Deluge.

But others take these to be the natural Places of their Birth or Formation, some of them being found little other than rude Clay; others of the same Texture with the Rock whereto they grow, and others of as absolute a shelly Substance as any in the Sea. In effect, these may be only so many different Gradations of Nature, which can as well produce *Shells* in Mines, as in the Sea; there being no want of saline or earthy Particles for the Purpose; nor is there any great Difference between some Sorts of Spars and Sea *Shells*.

Dr. *Lister* judges, that the *Shells* found in some Quarries were never any Part of an Animal; and gives this Reason for it, that Quarries of different Stones, yield quite different Species of *Shells*; different not only from one another, but from any Thing in Nature besides, which either Sea or Land does yield.

The Sea *Shells*, which are always found near the Shores, and never far off in the Deep, are called *litoral Shells*.

Those which are found in the Bottom of the Sea, remote from the Shore, are called *Pelagicæ*.

The SPAR has also its Place in *Natural History*, and is a shining, stony, mix'd Substance, compounded of Crystal, incorporated with Lac Lunæ, or other mineral, earthy, stony, or metallick Matter; frequently found in Caves and Grotto's, and in the Clefts of Rocks, Lead-Mines, &c.

Mr. *Beaumont*, in the *Philosophical Transactions*, endeavours to account for the Origin and Growth of Spar; which he makes to be a Kind of Rock Plant.

Spar, he observes, may be formed three Ways; either from Streams alone; or from Steams coagulating Dew, as it falls on the Ground, or Waters issuing from the Joints of Rocks: Or it may grow from Earth and Clay. To say nothing of the Account we have from *Switzerland*, viz. that Snow, by long laying, and continual Frosts, becomes harden'd into *Spar*.

We have Instances of the first Kind in many Grotto's, where *Spars* produced from Steams, hang like Icicles; Lead Ore being often found to grow in the same Manner. And as this *Spar* grows downwards; so in many Places, from the Sides of it, issue little Plants of *Spar*, shooting upwards, contrary to the Tendency of the others. An Instance of the second we have in a certain Place in *Italy*, where Crystals (which are a Sort of *Spars*) are produced in clear Evenings, from a Coagulation of Dew falling on nitrous Stones; but heretofore we have Instances enough nearer home.

For the third Kind of Generation of *Spar*, never before taken Notice of by Naturalists, Mr. *Beaumont* gives

us the following Instances of it in *Mendip Hills*, and other Mines, wherein are subterraneous Vaults or Grotto's. In the Bottom of some of these, is a Steam incumbent thereon. From this Earth shoot up Spires of various Heights, &c. from the first Buddings out of it, till it becomes as high as a Man's Finger; the biggest ordinarily an Inch in Diameter. These Spires have all irregular Ridges and Furrows; and some sooner, some later, begin on the Top to be congealed into *Spar*, and so gathering a Crust downwards by Degrees, are all at last, turned into one absolute white *Spar* or Stone.

The *STALACTITES*, or *STALAGNITES*, or *STANONITES*, is a starry, sparry Sort of Icicles, which hang down from the Tops or Arches of Grotto's, and subterranean Caverns; and from the Roofs of Buildings, and Capitals of Pillars of such Places as are built over hot Springs, &c.

Of this Kind are the *sal Alumen*, and *Vitriolum Stalacticum*; the *Minera ferri Stalactica*, the *Vitriolum Capillare*, &c.

The *Stalactites*, which incrustate or line the Tops and Sides of Caves, &c. are manifestly formed of Exsudations or Exstillations of petrifying Juices out of the neighbouring rocky Grounds. Those in the Cave on the Top of *Bredon Hill*, Mr. *Derham* fancies, might be formed by the Rains soaking through, and carrying with it Impregnations from the Stone; the Hill, there, being all rocky.

There is, also, in Natural History, a Kind of figured fossil Stones, resembling Plants, called *TROCHITÆ*, or *TROCHITES*, vulgarly *St. Cuthbert's Heads*.

They are usually of an opaque, dark Colour, break like Flint, glossy and shining, and are easily dissolved in Vinegar.—Their Figure is generally cylindrical, sometimes a little tapering; the Circumference smooth, and both the flat Sides covered with a fine Radii, drawn from a certain Hole in the Middle to the Circumference.—Two or three, or more of these *Trochite* joined together, constitute what the Naturalists call an *Entrochos*.

The *Trochite*, or simple Joints, are so set together, that the Rays of one enters into Furrows in the other, as in the Sutures of the Skull.—They are found in great Plenty in the Bodies of the Rocks at *Broughton* and *Stock*, two Villages at *Craven*, at all Depths under Ground; and in *Mendip Hills*, &c. sometimes only sprinkled here and there, and sometimes in large Strata, or Beds of all Magnitudes, from the Size of the smallest Pin, to two Inches about.

They are generally found ramous and branchy, larger Branches arising from the Stem, or Cylinder, and smaller from there: The Branches being deeply inserted into the Stem, the tearing them off leaves great Holes therein.

Dr. *Lister* has discovered a Sort of little Fragments among them, which he takes to have been the Apices of the Plants; and another Sort, which he supposes to have been the Roots. In Effect, the *Trochite* are generally allowed to be the Bodies of Rock Plants, such as Coral is.

Mr. *Beaumont*, in the *Philosophical Transactions*, assures us, that he has found that all the Clefts in some Mines are made up of these Stone Plants, some whereof have been converted into Lime-stone Rocks, while in their tender Growth; while others becoming *Spar*, compose Bodies of that Substance: And considering that all the Cliffs, for a very large Circumference in some Places, consist wholly of these Plants, we may say there have been, and in all Probability still are, whole Fields or Forests under Ground, as there are of Coral in the Red Sea.

In the Courses between the Cliffs, are found of these Plants at all Stages and Degrees of Maturity, growing up in the gritty Clay, and rooted in the rake-mold Stones, many of them of the Form and Dimensions of a Tobacco-Pipe, some yet crude or raw Clay, others of the Consistence of Lime stone, others still harder, with the evident Beginnings of Circles and Sutures, and others full grown, and become perfect *Spar*, which is their Point of Maturity.

The Pith continues still white and soft, as the whole Plant no doubt was at first; and is continually refreshed by the mineral Steams and Moisture which have free Access to it, through fine hollow Slits, or Feet in the figured Roots, or through the Moss of Clay usually lay-

ing under the plain Roots.

Nor can it be denied, but these Stone-plants have true Life and Growth. In the Curiosity of their Make, they may vie with most of the vegetable Kingdom, and are shaped and formed like them, having Stem, Branches, Roots, an inward Pith, as likewise Joints and Runnings in their Grit, and sometimes Cells to supply the Place of Veins and Fibres; why then may not they be allowed as proper Vegetations, as other Plants?

Indeed it is highly probable, these Rock-plants are *Lapides Suigmeris*, and not Parts of Animals or Plants putrified, as many Authors have imagined. If the figured Roots whereon they sometimes grow, give any Suspicion they might have belonged to an Animal, particularly a Species of the *Stella Arborescens*, the Truth clearly evince the contrary, and can never be look'd on as Parts of an Animal; nor are they reducible to any known Species of Vegetable. Mr. *Beaumont* tells us, that he had by him above 20 different Species of *Trochites*, all of them wonderfully regular, and not to be paralleled by any Vegetable he knows of in Nature: And it is inconceivable how so many Species diffused thro' many Parts of the Earth, should come to be lost.

In the Clay where *Trochites* are found, the Stone called *Cornu Ammonis* is frequent.

The *CORNU AMMONIS*, is an extraordinary Kind of Stone, which in Vinegar, Juice of Lemons, &c. has a Motion like that of an Animal.

It is rough, knotty, of an Ash-colour, and crooked in Manner of a Ram's Horn, such as those wherewith the Antients represented *Jupiter Ammon*: Whence its Name.

It is disputed among Naturalists, whether it be a Fossil or a Nautilus, or a Rock-plant? *Camerarius* maintains the first, urging that it is frequently dug out of the Tops of Mountains; and that it is seldom found near the Seashore.

Dr. *Woodward* asserts it a Shell, and of the Number of the *Nautilies* formed in the Sea, and carried thence by the Waters of the Deluge into the Countries where it is dug. He argues, that if it be rarely found on the Sea-Coasts, it is because Shells and other Bodies fastened to the Bottom of the Sea, as most Kinds of the *Cornua Ammonis* must be, are only torn thence and driven ashore by Tempests: But the most violent Tempests never move the Bottom of the Sea, as the Divers have put past Doubt; so that it is no Wonder if none of the *Cornua* be thrown up: But in the overturning of the Earth by the Deluge, then, with a thousand more Productions of the Sea, might be thrown from the Bottom of the Waters, to the Places where they are now found.

The *Cornu Ammonis* are of different Thicknesses and Lengths; some of them weigh about three Pounds: They are found in several Places in *Germany*. From some Experiments that have been made therewith, they are found to contain a little Quantity of Gold, which sinks to the Bottom upon pounding them small, and stirring them in a running Water, till all the earthy Parts are carried off.

'The Stone *Cornu Ammonis*, says Mr. *Beaumont* in the *Philosophical Transactions*, is frequent in the Clay wherein the *Trochites* and *Entrochi* are found; the largest I have is seven Inches in Length, and four in Circumference at the big End, and two and a half at the smaller, the Tip being broke off. Tracing its Origin, I find some of the first Buddings out of it about the Bigness of a young Cock's Spur, and very much like it: I have some in raw Clay, and one growing on a great cawky Stone. They generally become at last a whitish Spar, and some Milk-white, as some of the *Trochites* are.

'There are of all intermediate Proportions between these two; tho' very few of any Bigness are to be found entire, but all broken, and imperfect Pieces. The Texture of the Stone is thus: Some have a molly Spar in their Insides, which takes up three Parts of the Stone, then from the sharp Top there grows thin flat Cells, or small Pipes of Spar set Edgewise one close to the other, which shoots towards the broad End, and appear outwardly like small Ridges or Seams. There are likewise Rings running round it, tending in their Growth towards the broad End, as in a Ram's Horn.

Most of the lesser Stones have very little mossy Spar within them, and some none, with Cells coming down inwardly from the Top of the Stone, resembling those in the Flowers of Coral that terminate its Branches. And doubtless if taken from their Bed in a seasonable Time would yield the like milky Juice.

One of the most curious Things inserted of late Years, in the *Natural History*, is the Ductility of *Spider Webs*, as explained by M. *Reaumur*. The ingenious Author observes, that the Matter whereof, *Spiders*, and *Silk-Worms* form their Threads, is brittle when in the Mass, like dry Gums. As it is drawn out of their Bodies, it assumes a Consistence much as Glass-Threads become hard, as they recede from the Lamp; though from a different Cause. The Ductility of this Matter, and the Apparatus thereto, being much more extraordinary in *Spiders* than in *Silk-Worms*, we shall only here consider the former.

Near the Anus of the Spider are six Papilla's, or Teats. The Extremities of the several Papilla's are furnished with Holes, that do the Business of Wire-drawers, in forming the Threads. Of these Holes, M. *Reaumur* observes, there are enough in the Compass of the smallest Pin-head, to yield a prodigious Quantity of distinct Threads. The Holes are perceived by their Effects: Take a large Garden-Spider ready to lay its Eggs, and applying the Finger on a Part of its Papillæ, as you withdraw that Finger, it will take with it an amazing Quantity of different Threads.

M. *Reaumur* has often told 70 or 80 with a Microscope, but has perceived that there were infinitely more than he could tell. In Effect, if he should say, that each Tip of a Papilla furnished a Thousand, he is persuaded he should say vastly too little. The Part is divided into an Infinity of little Prominences, like the Eyes of a Butterfly, &c. Each Prominence, no doubt, makes its several Thread; or rather, between the several Protuberances, are Holes that give Vent to Threads; the Use of the Protuberances, in all Probability, being to keep the Threads at their first Exit, before yet hardened by the Air, asunder. In some *Spiders* those Protuberances are not so sensible; but in Lieu thereof there are Tufts of Hairs, which may serve the said Office, viz. to keep the Threads apart. Be this as it will, there may be Threads come out at a thousand different Places in every Papilla; consequently the Spider having six Papillæ, has Holes for above 6000 Threads. It is not enough that these Apertures are immensely small, but the Threads are already formed, before they arrive at the Papilla; each of them having its little Sheath, or Duct, in which it is brought to the Papilla from a good Distance.

M. *Reaumur* traces them up to their Source, and shows the Mechanism by which they are made. Near the Origin of the Belly he finds two little soft Bodies, which are the first Source of the Silk. Their Form and Transparency resemble those of Glass Beads, by which Name we shall hereafter denote them. The Tip of each Bead goes winding, and makes an Infinity of Turns and Returns towards the Papilla. From the Base or Root of the Bead, proceeds another Branch much thicker; which winding variously, forms several Knots, and takes its Course like the other, towards the hind-part of the Spider. In these Beads and their Branches is contained a Matter proper to form the Silk, only that it is too soft. The Body of the Head is a Kind of Reservoir; and the two Branches, two Canals proceeding from it. A little further backwards there are two other lesser Beads, which only send forth one Branch a-piece, and that from the Tip. Beside these, there are three other larger Vessels on each Side of the Spider, which M. *Reaumur* takes for the last Reservoir, where the Liquor is collected: The biggest is near the Head of the Insect, and the least near the Anus. They all terminate in a Point; and from the three Points of these three Reservoirs it is that the Threads, at least the greater Part of the Threads drawn out of the three Papillæ, proceed: Each Reservoir supplies one Papilla. Lastly, at the Root of the Papilla are discerned several fleshy Tubes; probably as many as there are Papillæ. Upon lifting up the Membrane, or Pellicle, that seems to cover these Tubes, they appear full of Threads, all

distinct from each other, and which of Consequence, under a common Cover, have each their particular one; being kept like Knives in Sheaths. The immense Quantity of Threads contained here, M. *Reaumur* concludes, upon tracing their Course, does not at all come from the Points of the Reservoirs, but some from all the Turns and Angles; nay, probably, from every Part thereof. But by what Conveyances the Liquor comes into the Beads, and out of the Beads into the Reservoirs, remains yet to be discovered.

We have already observed, that the Tip of each Papilla may give Passage to above a thousand Threads, yet the Diameter of that Papilla does not exceed a small Pin's Head; but we were there only considering the largest *Spiders*.

If we examine the young rising *Spiders*, produced by those, we shall find that they no sooner quit their Eggs, than they begin to spin; indeed their Threads can scarce be perceived, but their Webs formed thereof may: They are frequently as thick and close as those of House-Spiders; and no Wonder, there being often 4 or 500 little *Spiders* concurring to the same Work. How minute must their Holes be? The Imagination can scarce conceive that of their Papilla! The whole Spider is perhaps less than the Papilla of the Parent which produced it.

This is easily seen; each great Spider lays 4 or 500 Eggs; these Eggs are all wrapped in a Bag, and as soon as the young ones have broke the Eggs, they begin to spin. How fine must their Threads be?

Yet is not this the utmost Nature does; there are some Kinds of *Spiders* so small at their Birth, that they are not visible without a Microscope. There are usually found an Infinity of them in a Cluster, and they only appear like a Number of red Points. And yet there are Webs found under them though well nigh imperceptible. What must be the Tenuity of one of these Threads? The smallest Hair must be to one of these, what the most massive Bar is to the finest Gold Wire.

The Matter whereof the Threads are formed, we have observed, is a viscid Juice. The Beads are the first Receptacles where it is gathered, and the Place where it has the least Consistence. It is much harder when got into the six great Reservoirs, whither it is carried by Canals from the former: This Consistence it acquires in good Measure, in its Passage, Part of the Humidity being dissipated, or secreted by Parts destined for that Purpose.

Lastly, the Liquor is dried still further, and becomes Thread, in its Progress through the respective Canals to the Papillæ. When these first appear out at the Holes, they are still glutinous; so that such as spring out of neighbouring Holes stick together: The Air compleats the drying.

By boiling the Spider more or less, the Liquor is brought to a greater or less Consistence, fit to draw out into Threads; for it is too fluid for that Purpose while yet inclosed in its Reservoirs.

The Matter contained in these Reservoirs, when well dried, appears a transparent Gum, or Glue, which breaks, when much bent; like Glass it only becomes flexible by being divided into the finest Threads. And probably it was on this Account Nature made the Number of Holes so immense. The Matter of Silk formed in the Bodies of *Spiders*, being much brittler than that formed in *Silk-Worms*, needed to be wound smaller: Otherwise we do not conceive, why she should form a great Number of Threads, which were afterwards to be re-united; a single Canal might have done.

A P P E N D I X.

Note, That as almost all natural Productions proceed from Seeds; and Seed are either fecundated, as those of Plants, or serve to fecundate other Bodies, as the human Seed; I'll conclude this Treatise by a Dissertation on *Seeds*, and on the Bodies fecundated thereby viz. *Eggs*.

Seed, Semen, taken in the general Signification of the Word, is a Matter prepared by Nature, for the Reproduction and Conservation of the Species, both in Men, Animals, and Plants.

Some Naturalists add, that even Stones, Minerals, and

and Metals themselves, have each their proper Seed in their Mines, and are produced and perpetuated thereby.

Seed, in the Animal Economy, is a white liquid Matter, or Humour, the thickest of any in the Body, separated from the Blood in the Testicles, and reserved in proper Vessels to be the Means of Generation. By chymical Analysis it is found to consist almost entirely of Oil, and volatile Salts, blended together by the Mediation of a little Phlegm. Its Activity Dr. Drake takes to be derived from the Salts wherewith it abounds, far more than any other animal Liquor.

The Parts concerned in the Preparation of the *Seed*, are the spermatick Arteries, which bring the Blood to be secreted into the Testicles; the Testicles and Parastatæ, where the Secretion itself is chiefly effected; the *Vasa Deferentia*, which convey the secreted Matter out of the Testicles; and the *Vesiculæ Seminales*, which receive and preserve it to be emitted in Coition.

The Blood received in small Quantities, into the spermatick Arteries, and there, by the particular Structure of the Parts, much diminished of its Velocity, is yet farther retarded about the *Corpus Pyramidale*, or *Varicosum*, and its redder and thicker Parts, carried off by Canals opening into the Veins. Thus render'd paler, and slower, it is received into the winding Recesses of the Testicles, where almost stagnating, it assumes an Ash-Colour, and is further prepar'd, thicken'd, &c. in the *Ductus Highmorianus*; whence slowly driven into the *Epididymidæ*, or *Parastatæ*, it is further prepared and elaborated in the Folds, and Complications thereof; and at length creeps slowly into the *Vasa Deferentia*, or *Ejaculatoria*. These consist, at first, of a thick, spongy Matter, and are very narrow, but growing sensibly wider, and then again narrower, in the winding Meanders hereof, the Humour is collected, its Motion abated, further elaborated, and concocted, and at last driven into the *Vesiculæ Seminales*, in the various Cells and Meatus whereof it is received, laid up, fixed, thicken'd, whiten'd, and rais'd to its last Perfection; in which State it is call'd *Seed*.

It is observable, that no Humour in the Body is generated so slowly, meets with so many Means to retard it, or to elaborate and concoct it when at rest, as the *Seed*. Some imagine, that in its whole retarded Progress, besides what is apparent, there is something still added to it from the nervous Vesicles; and something taken away by the various Sympathicks, and discharged thereby into the venous Vesicles of the *Corpus Pyramidale*, and the little Veins of the *Vesiculæ Seminales*, and thence into the Humours of the whole Body: *Boerhaave* takes both the one and the other to be very probable.

The *Seed*, or Humour thus formed in the Testicles, *Parastatæ*, *Vasa Deferentia*, and *Vesiculæ Seminales*, being, when new, diluted with a little warm Water, and viewed with a good Microscope, seems to consist of innumerable, little, oblong, living, Eels-like *Animalcula*, floating in the other Part of this Humour. This is said to be always observed in the *Seed* of all Men, Quadrupeds, Birds, Fishes, amphibious Animals, and Insects.

Upon comparing this with the Bulk, Figure, Place, Change, &c. of the *Carina* of the Chick described by *Malpighi*, and with the known Law of Nature, observed in the Generation of Frogs, it appears highly probable, that the *Animalcula* of the Male *Seed*, contain the Rudiments or Stamina of the future human Body; and the more so, since, whenever the Testicles, or this Humour is wanting, there is always Sterility of the Side of the Male.

M. *Leeuwenhoek*, the first Discoverer of these *Animalcula*, and many after him, make no Scruple to call them true Foetus's, little Men; and some have even pretended to discover somewhat of the human Figure therein. But *Verbyen*, and others after him, deny the Existence of any such *Animalcula*; maintaining that it is only the Intelline Motion of the Parts of the *Seed* kept on Foot by the Warmth thereof, that exhibits the Appearance, which fanciful Persons have improved into tricking *Animalcula*; and urging, in Confirmation hereof, that no sooner is the Warmth gone, than all Appearance of *Animal* ceases. But this notwithstanding, the Doctrine of *Animalcula in semine*, seems now pretty generally received.

Some admit of four several Kinds of *Seed*: The *Seed*

of the Testicles, that of the *Vesiculæ Seminales*, that of the *Prostates*, and that of the Glands of the *Penis*.—The two first, which we have described as one and the same Humour, only in different Stages, those Authors take to be different, as not being able to find any strict Communication between the *Deferentia* and the *Vesiculæ*; but that Communication is fully shewn by Dr. Drake, so that nothing needs farther to shew the *Seeds* the same.—The Liquor of the *Prostates*, and that of the Glands of the *Penis*, are generally allow'd not to be any true *Seed*, no more than that emitted by Women: Nor is there any good Reason why any of them should be called so, as their Appearance is very different, and as other sufficient Uses are assigned for them, viz. to line and lubricate the Parts, that the *Seed*, Urine, &c. may pass more freely and without adhering.

The feminal Liquor, however, such as is emitted for Use, is a Mixture of several Fluids, poured at the same Time into the feminal Canal of the *Urethra*, either from the Glands that have secreted them, or the Reservoirs that have kept them. M. *du Verney* observes, that in different Species, the Number and Structure of these Organs is different. In Men the principal are the *Vesiculæ Seminales*, and the *Prostates*, besides what was discover'd by M. *Coeper*, viz. a Number of glandulous Bodies on each Side the *Urethra*, whose excretory Ducts open into the *Urethra*, towards the Root of the Yard. M. *du Verney* has found that the same are likewise in most other Animals, and placed in the same Manner.

It is controverted, whether or no the Liquor filtrated thereby, be necessary to Generation? M. *du Verney* thinks it is, and his chief Reason is, that in Animals that have been castrated, these Glands, as well as all the other Sources of Generation, are found dried up, and decayed. M. *Littre* objects to this, that the *Vesiculæ Seminales*, and *Prostates*, having little Cells where their filtrated Liquor is deposited, it is easily conceived, that their Humours may wait sometimes for an Occasion of being emitted; but that these new *Prostates* or Glands of M. *Coeper* having no such Reservoirs, that Liquor must ooze out into the Cavity of the *Urethra*, in Proportion as it is separated, and be destined for some continual, not a momentary Use. He adds, that as the excretory Ducts of these Glands traverse the spongy Body of the *Urethra*, for two Inches ere they penetrate into its Cavity, and that the sole Moments when the Liquor should be discharged, to assist in Generation, that spongy Body is extremely dilated, and its Sides in a State of Compression, the Liquor must be then less disposed to a Discharge than ever.

Seed, in Botany, is the last Product of a Plant, whereby the Species is propagated. The *Seed* is frequently the Fruit of the Plant, as is the Case of most Herbs. Sometimes it is only a Part inclosed in the Fruit, and that in Form either of Grain, Kernel, or Berry.

The *Seed* is the natural Offspring of the Flower, and that for whose Production all the Parts of the Flower are intended; so that when this is once well formed, the several Parts of the Flower dwindle and disappear.

It is supposed to be produced by the Farina of the Apices, let fall on the Head of the Pistil, and thence forwarded to an Uterus at the Bottom thereof, divided into several Cells; where, coming to receive the nutritious Juice of the Plant, it is first softened, then swelled, increased both in Matter and Bulk, and at length comes to its State of Maturity.

That the whole Plant is contained in the *Seed*, is an Opinion as old as *Empedocles*, and is still the prevailing Doctrine among the Generality of Naturalists. Experience, the Microscope, and the modern Philosophy, give it great Countenance. In Effect, by the Use of good Microscopes, we discover in the *Seed* several of the Parts of the future Tree, only in Miniature; particularly a little Root called the *Rachis*, and the Stem called the *Plumule*.

In *Malpighi's* Life, we have a Debate between him and Signior *Triumphetti*, Provost of the Physick College at Rome, whether the whole Plant be actually contained in the *Seed*? The Affirmative is maintained by *Malpighi*, with cogent Arguments; among which, one, that in a Kidney Bean fresh sown, the Eye, with a Microscope, easily discovers the

and even the Knots, or Implantations of the Leaves on the Stem. The Stem itself is very conspicuous, and plainly consists of woody Fibres, and Series's of little Uricles. And whereas Signior *Triumphetti* had objected, that by Poverty, Transplantation, &c. they degenerate into others; particularly Wheat into Tares, and Tares again into Wheat. In Answer to this, which is one of the strongest Objections against that Opinion, *Malpighi* replies, that he is not fully satisfied as to the Truth of the Objection; for that both himself and his Friends, the making the Experiment, no Metamorphosis of the Wheat succeeded. But granting the Metamorphosis, it is the Soil, Air, or Culture, is in the Fault. For, from a morbid and monstrous Condition of Nature, there is no inferring her genuine and permanent State.

To the same Effect, *M. Leewenhoeck*, after a nice Observation of an Orange-Kernel he had made to germinate in his Pocket, &c. concludes, "thus we see how small a Particle, no bigger than a coarse Sand, is increased, &c." a plain Demonstration that the Plant, and all that belong to it, was actually in the Seed, viz. the Body, Root, &c. Mr. *Derham* adds, that of all the Seeds he has viewed, except the Maple, the Plant appears the plainest to the naked Eye in the *Nux Vomica*.

The Fecundity of Plants in the Production of Seed, is very surprizing. *M. Dodart*, in the Memoirs of the French Academy of Sciences, computes, that an Elm, living 100 Years, ordinarily produces of itself 33000000 Grains; and adds, that had his Crown or Head been cut off, it would have put forth as many Branches, within half an Inch of the Place where it was cut, as it had before; and that at whatever Height it were cut off, the Effect would have been still the same. — Hence he concludes, that the whole Trunk, from the Ground to the Rise of the Branches, is full of the Principles or little Embrio's of Branches, which, it is true, cannot all appear at once, but which being conceived, as separated by circular Reins, half an Inch high, compose so many Sets of Branches, each whereof is ready to appear, and will really appear, if the Head be chopped off just over it.

Now these invisible Branches exist as really as those which appear. For whence else should they come? The Trunk cannot produce them, as being itself no more than a Packet of Fibres, destitute of all Action: Nor can the Sap, which like the Blood, is fit to nourish the Parts, but not to form any new ones. The Branches thereof existed before the Tree was lopped; and if they had appear'd, would have bore an equal Number of Seeds, as those which did. These Seeds, therefore, they must already contain in little.

On which Footing, the Tree may be said actually to contain in itself 158400000000 Seeds, wherewith to multiply itself as many Times. But what shall we say, if each Seed, or Grain of a Tree, contains in itself another Tree, containing the same Number of Seeds? And if we can never get either at a Seed, which does not contain a Tree, nor at a Tree which does not contain Seed? By this Means we shall have an increasing geometrical Progression, the first Term whereof is 1, the second, 158400000000; the third, the Square 158400000000; the fourth, in Cube, &c. to Infinity.

Several Species of Plants have been always supposed to be destitute of Seed, in Regard no Observation, no Microscope, no Anatomy had discover'd any Thing like them: Such are the Capillaries, the several Kinds of Fuci, Sea Plants, Mosses, &c. But the happy Industry of the present Age has discover'd the Seeds of some of them; and has left us out of all doubt, that the rest are not without the same.

The Seeds of Fern, and the Capillary-Plants, were first discover'd by *Cassius*; and since more fully and critically by Mr. *William Cole*. The Seeds of some Sea-Plants were discover'd by the Count *de Marsigli*, and those of others by *M. Reaumur*; the first mention'd in the History of the French Academy for the Year 1712, and the latter for the Year 1711. The Seeds of some Sorts of Fuci have been discover'd by Mr. *Samuel Doody*: Those of Coralloid Shrubs, by Dr. *Tancred Robinson*, as also those of several Fungi, particularly Truffles, and *Crepitus Lupi*, or Puff-Balls; and those of some other by Dr. *Lifter*.

The MUSHROOM, which is a Plant of a Form and Structure very different from that of all other Plants, has neither Seeds, nor Flowers, that have ever yet been discover'd.

The Origin and Production of Mushrooms, has extremely puzzled the Naturalists. How a Plant should be produced without a Seed is a Mystery; and yet the best Microscopes are not able to discover any Appearance of a Seed; and the Manner of cultivating this Plant, seems to make it still more probable that it has not any.

M. Tournefort gives a very curious Account of their Culture, in the Memoirs of the Royal Academy, with the Substance of which we shall here present the Reader. All the Secret of bringing up Mushrooms speedily, and in Abundance, consists in ranging Balls of Horse-Dung, about the Bigness of the Fist, in Lines, at the Distance of about three Feet from each other, and at the Depth of one Foot under Ground, and covering these over with Mould, and that again with Horse-Dung.

If this be done in April, in the Beginning of August the Pieces of Dung will begin to whiten, and grow mouldy, being cover'd all over with little Hairs, or fine white Threads, branched and woven about the Straws whereof the Dung is composed. The Dung now looses its former excrementitious Smell, and spreads an admirable Odour of Mushrooms.

According to all Appearance, these white Threads are no other than the open'd Seeds or Buds of Mushrooms, which Seeds were before inclosed in the Dung, but in so small a Compass, that they could not be perceived till after they had shot themselves into little Hairs. By Degrees the Extremity of these Hairs grows round, into a Kind of Button, which swelling by little and little, at length opens itself into a Mushroom, whereof the lower Part is a Kind of Pedicle bearded in the Place where it enters the Ground, and at the other End loaded with a roundish Capital or Head, in the Manner of a Shalot, which expands itself without producing either Seeds or Flowers that are sensible; the Bottom is spread with Laminæ, which proceeding from the Center to the Circumference, may be called the Leaves of the Mushrooms.

At the Foot of each Mushroom, are found an infinite Number of little ones, not bigger than the Head of a Pin, when the others are at their Growth. The Buds of the Mushrooms, or the white Hairs of the Dung, preserve themselves a long Time without rotting, if kept dry; and if laid again on the Ground will produce new Mushrooms.

Mushrooms, then, are nothing else but the Produce of what we call the Mouldiness of Horse-Dung: But what Analogy is there between these two Things? Or how should so artful and delicate a Structure as this of a Plant, result from the mere fortuitous Concourse of a few Juices differently agitated?

It seems past doubt, then, that Mushrooms, like all other Plants, have their Origin in Seeds: Now we know that the Seeds of Plants cannot vegetate every where; there are first requir'd certain Juices proper to penetrate their Coats, to excite a Fermentation, and to join themselves to the little Parts thereof, and increase them. Hence arises that infinite Diversity of Places, wherein different Species of this Plant are produced. There are some which will only grow on some other particular Plants, whose Trunk, Bark, or Roots, alone have their Juices proper for them.

What *M. Tournefort* mentions from Mefs. *L'Emery* and *Mery*, is still more surprizing; there is a Species of Mushrooms, which grow on the Lillies and Bandages applied to the Fractures, &c. of the Patients in the *Hôtel-Dieu*. After which, it will not be at all surprizing, that Horse-Dung, prepared in the Manner *M. Tournefort* mentions, should be a Soil or Matrix capable of making Mushrooms grow.

Hence it seems to follow, that the Seeds of Mushrooms should be spread in an infinite Number of Places where they do not vegetate, and in a Word throughout the whole Earth; and the same may be said of a great Number of other Plants.

It must be own'd, the Imagination is shocked at such a prodigious Multitude of different Seeds thrown every where at Random, and in many Places to no Purpose; but

but a little Reasoning will put the Matter of Fact past Doubt.

Dioscorides tells us, he was assured, that Pieces of the Bark of Poplar Tree being laid in the Ground over Horse-Dung, there would grow out of them very good *Musbrooms*. *Ruel* says, that by boring the Trunk of a white Poplar-Tree near the Root, and washing it with Leaven steeped in Water, *Musbrooms* spring out of it, as it were, instantly. He adds, that the Hillocks produce several Kinds of *Musbrooms*, if the Stubble be burnt on them in the rainy Season.

M. *Tournefort* tells us, on his own Knowledge, that where the Stubble is burnt, as in *Provence*, *Languedoc*, and the Islands of the *Archipelago*, there arise great Quantities of black Poppies in the first autumnal Rains, which disappear the Year following; so that they are never found but on burnt Lands. And it is known, here in *England*, that after the Burning of *London*, the Ground as far as the Fire reached, shot up with vast Quantities of *Erysimum Latifolium majus Glabrum*. One of the chief Reasons, if not the only one, why Mountains produce Plants different from Plains or Valleys, and Places become fenny, from the same Places when they were dry; is the Difference in the nutritious Juices found in those Places. Without this, how shall we account for the Origin of Mistletoe or Hypocistis, which are never known to grow in the Earth, at least without adhering to some other Plant; but the one grows on Trees, and the other to the Root of the Cystus? Why do the Ivy, and Vine of *Canada*, Pellitory, Polipody, the Species of Capillaries, grow only on the Trunks of Trees, on Walls, and in the Clefts of Rocks, unless it be that the Juices of those Places are the best adapted to them.

These, and other incontestable Facts, prove plainly, both the vast Multitude of *Seeds* dispersed every where, and the Necessity of certain Circumstances, to make them vegetate.

If to this Speculation on the invisible *Seeds* of Plants, we join that of the invisible Eggs of Insects, which must be allowed equal thereto, the Earth will be found full of an inconceivable Infinity of Animals and Vegetables, perfectly formed and designed, as it were, in Miniature, and only waiting for certain favourable Circumstances. To enable them to make their Appearance in large, how rich then must the Hand be that has sown with so much Profusion?

We have been the more particular on this Head, on Account of the Oddness of the Phænomena; and because what is here said of *Musbrooms*, will give Light into the Generation of all other Vegetables, &c. whose *Seeds* are yet undiscover'd.

Dr. *Lister*, indeed, thinks he has found out the *Seeds* of *Musbrooms*. He instances, particularly in the *Fungus Porofus Crassus*, I. B. the Texture of whose Gills, is like a Paper pricked full of Pin-Holes. These Gills, he makes no doubt, are the very Flowers and Seeds of this Plant; when it is ripe, the Gills are easily separable from the rest of the Head, each Seed being distinct from other, and having its Impression in the Head of the *Musbroom*, just as the Seed of an Artichoke has in the Bottom of it: The big End of the Seed is full and round, and they are disposed in a spiral Order, like those of the Artichoke: And the same he thinks will hold of all other *Musbrooms*, however differently figured. If it happens that these, when sown, prove sterile, and do not produce their Kind, it is no Wonder; there being whole Genus's of Plants that come up, and flower, and seed; yet their Seed was never known to produce Plants of their Kind, being no more than a barren volatile Dust, as that of all the *Orchides*, or Bee-Flowers are said to be.

There are various Kinds of *Musbrooms*; and the Vulgar call by this Name all that come under the general Name of *Fungus*'s; by the *Greeks* called *μυκνίς*.

Mr. *Bradley* mentions a hundred Kinds of *Musbrooms*, which he has seen in *England*; besides those very numerous small ones, which constitute the Mouldiness of Liquors, Fruits, &c. which last are such quick Growers, that they arrive at Perfection in less than twelve Hours.

The *Pungolles* only differs from a *Musbroom* in its external Form; the *Corallines* are of the same Species, though of a different Name, as being branched like Co-

ral, and Truffles come under the same Kind.

Mathiolus mentions *Musbrooms*, which weighed thirty Pounds each, and were as yellow as Gold. *Fer. Imperatus* tells us, he saw some which weighed above a hundred Pounds; and to add no more, the *Journal des Savans* furnishes us with an Account of some growing on the Frontiers of *Hungary*, which made a full Cart-Load.

Musbrooms are all used with some Suspicion, tho' some are more harmless, as well as more delicious than others. Those used in *England* are *Musbrooms of the Wood*, called *Morilles*; and of the Meadows called *Champignons*; which are gather'd in Autumn, and esteemed for their Whiteness above, their Carnation underneath, and the Sweetness of their Smell.

TRUFFLES, *Tubera terra*, is a Kind of subterraneous vegetable Production, not unlike *Musbrooms*.

The antient Physicians and Naturalists, rank *Truffles* in the Number of Roots, Bulls, or Cloves; and define them to be a Species of Vegetables, without Stalks, Leaves, Fibres, &c. *Bradley* calls them *under Ground edible Musbrooms*, or *Spanish Truffles*.

They are produced most in dry chapped Grounds, and that, as *Pliny* says, chiefly after Rains and Thunder, in Autumn. Their Duration he limits to a Year. Their Colour is uncertain; some being white, others black, &c.

In *Italy*, *France*, &c. they eat them as a great Dainty, either fryed in Slices with Oil, Salt, or Pepper, or boiled over again in their own Broth. The Hogs are exceedingly fond of them, and are frequently the Means of discovering the Places where they are; whence the common People call them *Swine-Bread*. The modern Botanists rank *Truffles* in the Number of Plants, though they want most of the usual Parts thereof. All we know of their Growth is, that they are first no bigger than a Pea, reddish without, and within whitish, and that as they ripen, the white Parts grow more dusky and black; only there are still left a Number of white Streaks, which all terminate at Places where the outer Coat is cracked, or open: And which, in all Probability, are the Vessels that convey the Nourishment into the *Truffles*.

In these Vessels is found a whitish Matter, which, when viewed with a Microscope, appears to be a transparent Parenchyma, consisting of Veliculae; in the Middle whereof are perceived little round black Grains, separate from each other, supposed to be the Seed of the *Truffles*.

When the *Truffles* rot in the Ground through Excess of Ripeness, these Grains are the only Thing that remain of them; and these are supposed to produce new *Truffles*, which grow one after another.

What confirms the Opinion of their coming from Seed is, that there have been *Truffles* lately discover'd in *England*, and this only in *Northamptonshire*, and even only in one Place thereof, viz. near *Rushdon*, a Place stocked with Plants formerly brought from *Languedoc*, and it is only since then, that any *Truffles* have been there observed; whence it is concluded, that the Seed of these *Truffles* was brought from *France* among the Roots of the other Plants.

These English *Truffles* were first discover'd by Dr. *Hatton*.—Dr. *Tancred Robinson* assures us, they are the true *French Truffles*, the *Italians Tartuffi*, or *Tartasole*, and the *Spanish Turmas de Siera*, being not noted by Mr. *Ray*, as ever known on English Ground. Indeed he adds, that he has seen them thrice as large at *Florence*, *Rome*, &c.

Those observed in *England*, are all included in a studded Bark or Coat, and the inner Substance is of the Consistence of the fleshy Part of a young Chestnut, of a Palle Colour, a rank or hircine Smell, and unflavoury.

By a chymical Analysis, *Truffles* are found to abound in a volatile alkali Salt mixed with Oil, upon which their Smell, &c. depends. They never rise out of the Ground, but are found usually half a Foot beneath the Surface thereof.

Dr. *Hatton* has observed several little Fibres issuing out of some *Truffles*, and insinuating themselves within the Soil, which, in all Probability, do the Office of Roots. The *Truffles* grow tolerably globular, as receiving their Nourishment all around them; they being to be consider'd like Sea-Plants encompassed with the

Food, which they suck in through the Pores of their Bark or Rind.

They are tenderest and best in the Spring, tho' easiest found in Autumn; the Wet swelling them, and the Thunder and Lightning disposing them to send forth their Scent, so alluring to the Swine. Hence some of the Antients call them *Ceraunia*, q. d. *Thunder-Stones*.

The Depth at which the *Truffles* lie, Dr. *Robinson* observes, is no Objection to their being of the vegetable Tribe; that being a Thing common to several other Plants which shoot up Stalks, particularly the *Lathyrus tuberosus*, commonly called *Chalnobalanus*, and *Terræ Glans*, in English, *Pease*, *Earth-Nuts*, the Roots of our *Bulbocastaneum*, &c.

The Antients are exceedingly divided as to the Use of *Truffles*; some affirming them to be wholesome Food; and others pernicious; *Avicenna* particularly, who will have them to cause Apoplexies. For my own Part, says M. *L'Emery*, I am of Opinion, they have both good and evil Effects; they restore and strengthen the Stomach, promote the Semen, &c. But when used too freely, they attenuate and divide the Juices immoderately, and by some volatile and exalted Principles, occasion great Fermentations, &c. though the Pepper and Salt they are ordinarily eaten withal, do doubtless contribute greatly to those Effects. Their rich Taste is owing to their not putting forth any Stalk; in Effect, their Principles being united, and, as it were, concentrated in a little Scab, must yield a richer and more delicious Savour, than if the Juices were dispersed by Vegetation, through the several Parts of a common Plant.—Some roast the *Truffles* under the Ashes, others pulverize and mix them in Sauces.

Note, That as we have already observed, that *Seed* serves for the Propagation of the different Kinds or Species, both in Animals and Vegetables; and that Propagation in Animals, is accomplished by the *Seed* fecundating the *Eggs* in the *Ovary*, we must inform ourselves next what those *Eggs* are; therefore,

Egg, is a Part formed in the Female of certain Animals; which, under a Shell or Cortex, includes an Embryo or Foetus, of the same Species; the Parts whereof are afterwards displayed and dilated, either by Incubation, or by the Accession of a nutritious Juice.

The Species of Animals that produce *Eggs*, are particularly denominated *oviparous*; and the Part wherein the *Egg* is formed the *Ovary*.

Of the various Kinds of *Eggs*, those of Hens, or Pullets, being the most usual, and which have been the most observed, we shall say somewhat of the Structure thereof, and the Generation of the Chick therein.

The exterior Part, then, of a Hen's *Egg*, is the Shell; a white, thin, friable Cortex, including all the other Parts, and defending them from Injuries. Immediately under the Shell lies the *Membrana Communis*, which lines the whole Cavity of the Shell, adhering pretty closely to it, except at the bigger End, where a little Cavity is left between them, which with Age grows bigger. Under this Membrane are contained two *Albumina*, or Whites, each wrapped up in its own Membrane. In the Middle of the inner White is the *Itelles*, or Yolk, inclosed likewise in its separate Involucrum or Cover. The outer Albumen is oblong or oval, accommodated to the Figure of the Shell: The inner is spherical, and of a more gross and viscid Substance; and the Yolk is of the same Figure.

At each End is a Chalaza, which are, as it were, the Poles of this Microcosm: These are white, dense Bodies, consisting each of three little Globules like Hail joined together: In these not only the several Membranes are connected, or knit together, by which Means the several Liquors are kept in their proper Place and Position to each other; but they serve also to keep one and the same Part of the Yolk uppermost, let the *Egg* be turned which Way it will.

Note, That the *Chalaza*, is a white, knotty Kind of String, at each End of an *Egg*, formed of a Plexus of the Fibres of the Membranes, whereby the Yolk and White are connected together. Its Use, according to *Harvey*, is to be, as it were, the Poles of this

Microcosm, and the Connection of all the Membranes twisted and knit together; whereby the Liquors are not only conserved, each in its Place, but also in its due Position to the rest. Mr. *Derham* adds, that they also serve to keep one and the same Part of the Yolk uppermost, let the *Egg* be turned which Way it will; which is done by the following Mechanism. The *Chalaza* are specifically heavier than the Whites wherein they swim; and being braced to the Membrane of the Yolk, a little out of the Axis, cause one Side of the Yolk to be heavier than the other. The Yolk being thus by the *Chalaza* made buoyant, and kept swimming in the Midst of two Whites, is by its own heavy Side kept with the same Side always uppermost: Which uppermost Side he imagines to be that whereon the *Cicatricula* lies; which *Cicatricula* is a little whitish Speck or Vesicle, in the Coat of the Yolk of an *Egg*; wherein the first Changes appear towards the Formation of the Chick. The *Cicatricula* is what is otherwise called the Eye of the *Egg*.

All these Parts of a Puller's *Egg*, are found in all other *Eggs*, to which the Definition of an *Egg* properly and strictly agrees: Such *Egg* being that of a Part whereof the Animal is formed, the rest serving for its Food. Accordingly the first Seed, or Stamen of the Chick, is in the *Cicatricula*.

The *Albumen*, or *White*, is the nutritious Juice, whereby it is distended and nourished till it becomes big, and the Yolk serves it for Food after it is well grown, and partly also after it is hatched. For a good Part of the Yolk remains after Exclusion; being received into the Chicken's Belly, as a Store-house, and conveyed thence by the *Appendicula*, or *Ductus Intestinalis*, as by a Funnel into the Guts, serving instead of Milk.

An *Egg*, improperly so called, is that of the whole whereof the Animal is formed: Such are the *Eggs* of Flies, Butterflies, &c. which *Aristotle* calls *Vermiculi*.

The two have this further Difference, that whereof the former, after they are excluded from the Female, need no external Nutriment, nor any Thing but Warmth and Incubation, to bring the Foetus to Perfection: The latter, after they are fallen out of the *Ovary* into the *Uterus*, require the nutritious Juices of the *Uterus* to distend and enlarge them: Whence they remain much longer in the *Uterus* than the other.

The principal Differences among *Eggs*, properly so called, is, that some are perfect, *i. e.* have all the Parts above described, while in the *Ovary* or *Uretus*; and others imperfect, as not having all these Parts till after they are excreted or laid; such are the *Eggs* of Fishes, which after they are brought forth, assume an Albumen to themselves from the Water.

Another Difference is, that these are fecundated, and others not: The first are those which contain a Sperm, injected by Coition of the Male, to dispose them for Conception, The rest not impregnated with this Sperm, never breed young by any Incubation, but always putrify.

An *Egg* fecundified, contains the Rudiments of the Chick before ever the Hen has set upon it. By the Microscope we see in the Middle of the *Cicatricula*, the plain *Carina* of the Chick, swimming in the Liquamen of Humour; it consists of fine white Zones or Threads, which the Warmth of Incubation enlarges, by rarifying and liquifying the Matter first of the Albumen, and then of the Vitellus, and pressing them into the Vessels of the *Cicatricula*, for a further Preparation, Digestion, Assimilation, and Accretion; till the Chick, too big for its Covercle, breaks the Shell, and is delivered.

It was antiently thought, that none but Birds and Fishes, with some other Animals, were produced *ab ovo*, *Eggs*; but the Generality of the Moderns incline to think, that all Animals, even Man himself, is generated the same Way. *Harvey*, *De Graaf*, *Kerckringius*, and several other great Anatomists, have so strenuously asserted this Opinion, that it now generally obtains.

In the Testes of Women, are found little Vesicles, about the Size of green Peas, which are accounted as *Eggs*; for which Reason, these Parts, which the Antients called *Testicles*, the Moderns call *Ovaries*. These

Eggs

Eggs fecundified by the most volatile and spirituous Parts of the Seed of the Male, are detached from the Ovary, and fall down the fallopian Tubes into the Uterus, where they grow and increase.

This System is countenanced and confirmed by Abundance of Observations and Experiments. M. de St. Maurice, upon opening a Woman at Paris, in 1682, found a Fætus perfectly formed in the Testicle.

Mr. Oliver, a Physician at Brest, in the Province of Britanny, attests, that in the Year 1684, a Woman, pregnant seven Months, was brought to Bed of a whole Plate full of Eggs, fastened together like a Bunch of Grapes, and of various Sizes, from that of a Lentil, to that of a Pigeon's Egg. Wormius assures us, that he had himself seen a Woman who had lain an Egg. And Bartholin confirms him, Cent. 1. hist. Anatom. 4. p. 2. The same Author tells us, he knew a Woman at Copenhagen, who, after twelve Weeks Conception, was delivered of an Egg wrapped up in a thin Shell. Lanzonus, Dec. II. An. ix. observ. 38. p. 73. of the *Curiosi Naturæ*, relates the same Thing of another Woman seven Weeks gone: The Egg she brought forth was of a Size between that of a Hen and a Pigeon, and was covered with Membranes instead of a Shell. The outer Membrane, or Chorion, was thick and bloody; and the inner, or Amnios, thin and transparent, including a whitish Humour, wherein the Embrio swam fastened by umbilical Vessels, like Threads of Silk.

Bonetus, in a Letter to Zuingerus, published in the Ephemerides of the *Curiosi Naturæ*, Dec. II. an. 2. observ. 186. p. 417. relates, that a young Maid had cast forth a great Number of little Eggs. Con. Viridungius observes, that in dissecting a Woman who had a Rupture, he found Eggs of divers Sizes in the Cornua of the Womb. Lastly, we meet with divers Instances of the same Thing in Rhodios, Cent. III. observ. 57. and in several Places of the Memoirs of the *Curiosi Naturæ*, inasmuch that Berger in his Treatise *De Naturâ Humanâ*, l. II. c. I. p. 461. makes no Scruple to give it as his Opinion, that the only Difference between Animals, called *oviparous*, and those denominated *viviparous*, consists in this, that the former cast their Eggs out of the Body, and lay them in Nests; and that their Eggs contain all the Nourishment requisite for the Fruit, or Fætus; whereas in the latter the Eggs are only laid from the Ovary into the Uterus; that they have but little Juice, and that the Mother furnishes the rest.

There is not so much as a Plant, whose Generation, according to the Sentiment of Empedocles, and since him of Malpighi, Rallius, Fabric. de Aquapendente, Grew, and others, is not effected by the Way of Eggs.

On the other hand we have many Instances of *viviparous* Animals producing their Young absolutely alive, and without Eggs. Such Instances we have of a Crow, a Hen, Serpents, Fishes, Eels, &c.

But this is not all, Naturalists afford Instances of Males, and even Men, casting out Eggs by the Fundament. But M. Stollerfoht is of Opinion, that at least in some of those Cases, what was taken for Eggs might be no more than certain Aliments ill digested, and coagulated; an Instance of which himself had seen. As to those of Women, Wormius and Froman, lib. III. de *fascinatione*, take it for the Effect of the Devil; but Bartholin and Stollerfoht, treat the Notion as it deserves, with Derision.

Goussset, de causis lingue hebraicæ, explodes the modern System of Generation *ab ovo*, as contrary to Scripture; and others imagine they have seen the Animal alive, and formed in the Seed of the Male.

Malpighi has made very curious Observations with the Microscope, of all the Changes that happen in the Egg, every half Hour of Incubation. Vossius, and divers other Authors, are very solicitous about settling the Question, which was formed first, the Egg or the Puller?

In Egypt they hatch their Eggs by the Heat of a Furnace; or Oven, and frequently have seven or eight thousand Chickens come forth at a Time. They have Houses it seems built for that Purpose, having a long Entrance, on each Side whereof are twelve or fourteen Ovens, whose Bottoms and Sides are formed of Sun-dried Bricks, lined with Mats for the Eggs to lie on,

and the Tops covered with Sticks, except two Spaces which are Brick, and serve as Hearths to build the Fire upon wherewith the Eggs are to be heated. Over this is another Story of Ovens; having Holes, which are either stopped with Tow, or left open at Pleasure, to govern the Heat of the Ovens below.

They begin to heat the Ovens in the Middle of January, spending every Morning about a hundred Pounds Weight of Camels or Bufallos Dung, and the like Quantity at Night, till the Middle of February; by which Time the Ovens are too hot for the Hand to be held upon the Walls. After this they put in the Eggs to hatch, which they continue successively till the End of May.

The Eggs are first put upon the Mats in the lower Ovens, upon the Ground, 7 or 8000 Eggs in Number, and laid only double one upon another; in the Ovens over these the Fire is made in the little Channels, from whence the Heat is conveyed into the lower; the Eggs directly under these Hearths lie three-fold.

At Night, when they new-make their Fires in the Hearths, they remove the Eggs that lie directly undermost, laying three one upon another, in the Place of those which lay on the Sides only double, and these being now removed, they lie treble under the Hearth, because the Heat is greater there than on the Sides.

These Eggs continue in the lower Ovens fourteen Days and Nights; after which they remove them into the upper. And in these there being now no more Fire used, they turn the Eggs four Times every twenty-four Hours.

The 21st or 22d Day the Chickens are hatched, which the first Day eat not; the second they are fetched away by Women, who give them Corn, &c. The Master of the Ovens hath a third Part of the Eggs for his Cost and Pains, out of which he is to make good to the Owners, who have two Thirds in Chickens for their Eggs, if any happen to be spoiled or miscarry.

The Fire in the upper Ovens, when the Eggs are placed in the lower, is thus proportioned. The first Day the greatest Fire, the second less than the first, the fourth more than the third, the fifth less, the sixth more than the fifth, the seventh less, the eighth more, the ninth without Fire, the tenth a little Fire in the Morning, the eleventh they shut all the Holes with Flax, &c. making no more Fire; for if they should the Eggs would break. They take Care that the Eggs be no hotter than the Eye of a Man, when they are laid upon it can endure. When the Chickens are hatched, they put them into the lower Ovens.

At Tonquin they are said to keep Eggs entire for the Space of three Years, by covering them up in a Paste made of Ashes and Brine. The Tortoise is said to lay no less than 1500 Eggs, which she covers in the Sand, and leaves the Sun to hatch them; and the Eggs of the Ostrich are hatched after the same Manner.

In the *Acta Erudit. Lips. Ann.* 1683, p. 221. Mention is made of a Hen's Egg, in all respect like the common ones, in the Middle whereof was found another, of the Size of a Pigeon's Egg.

Eggs with double Shells, are no unusual Phenomenon. Harvey is very large on the Rational of these Appearances, in his Treatise *de generat. Animal.*

Even Insects are produced from Eggs, as plainly demonstrated in my Treatise of Animals, under the Letter A, speaking of the Generation of Insects.

The Fleas and Lice, those domestick and troublesome Vermin, are also generated from Eggs.

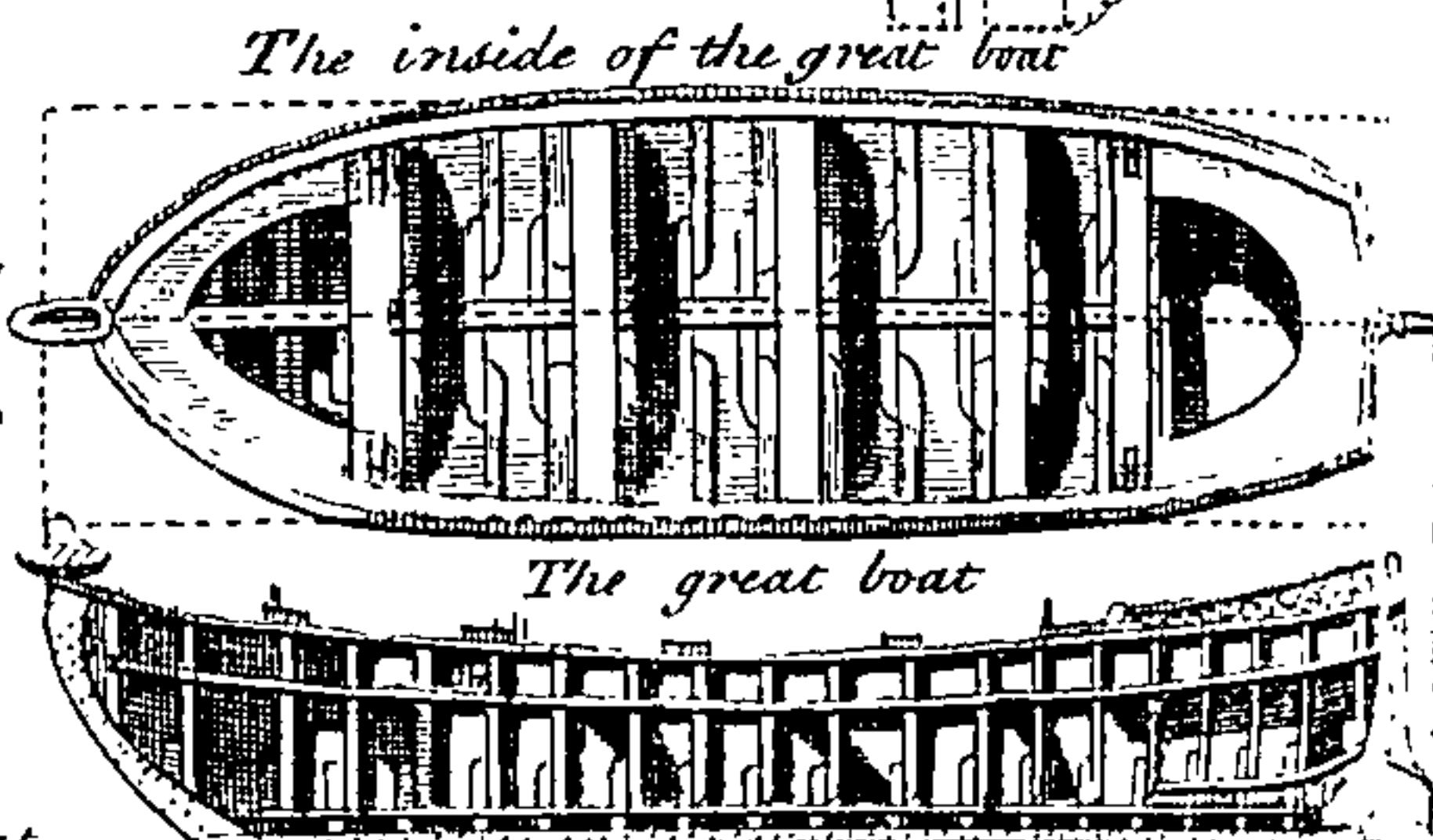
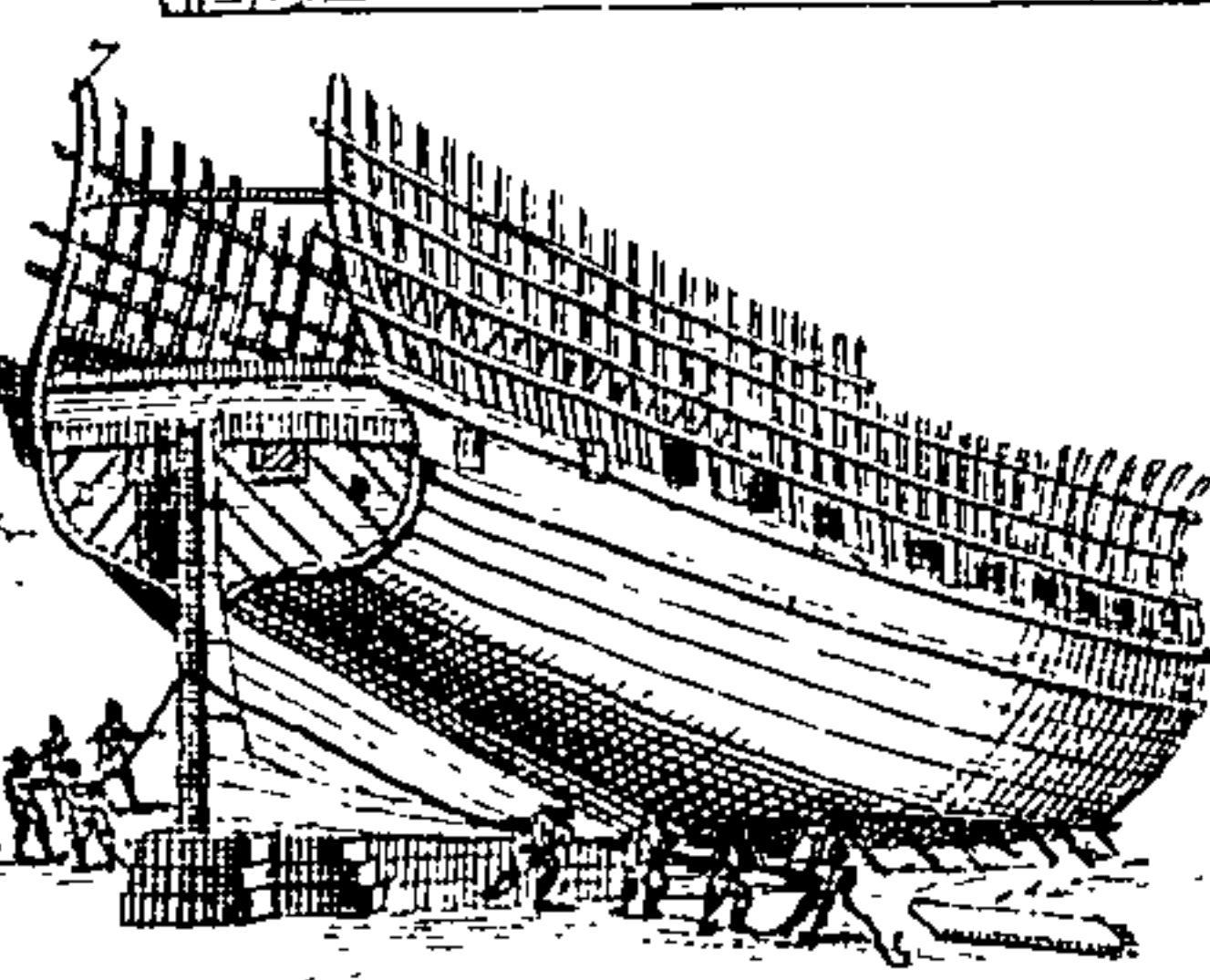
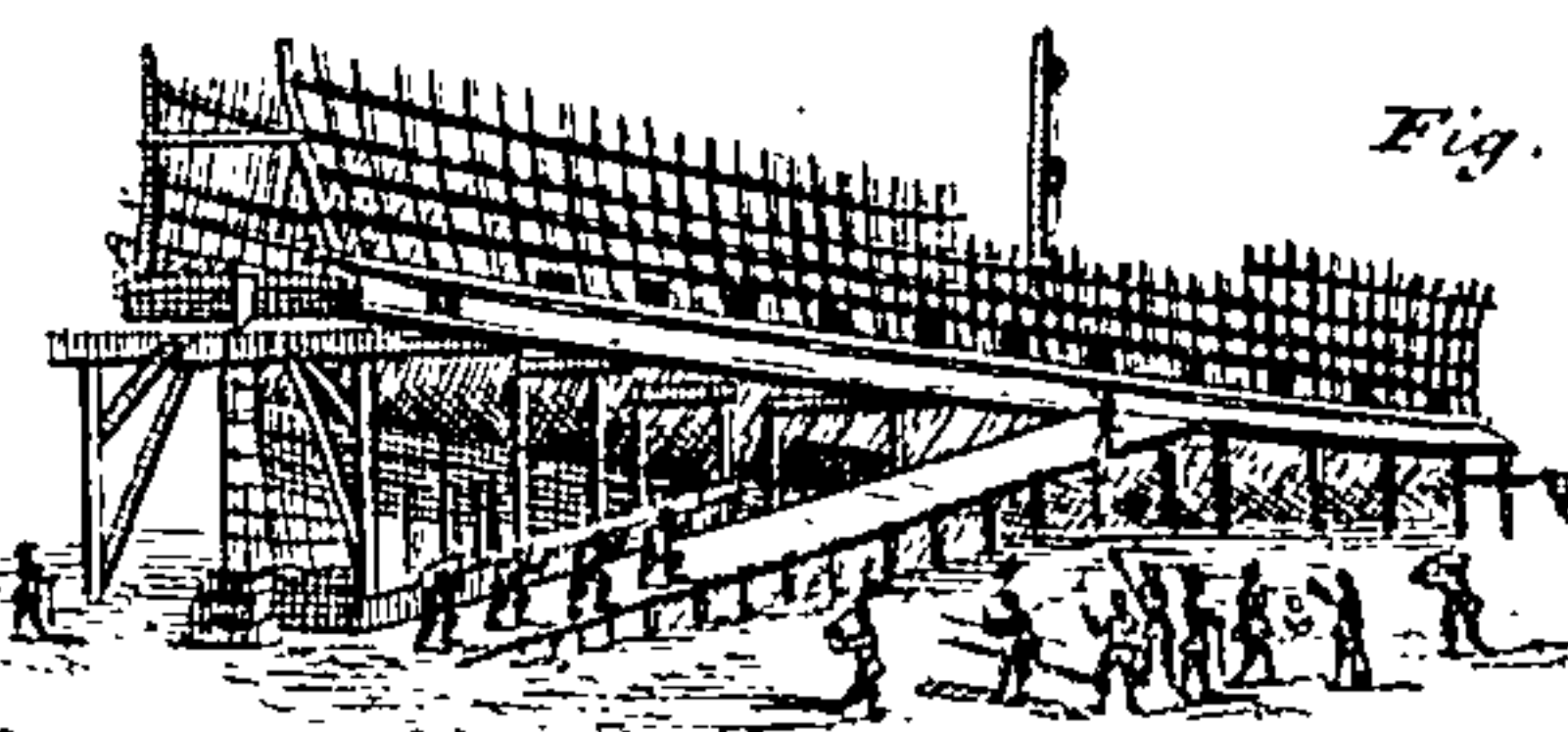
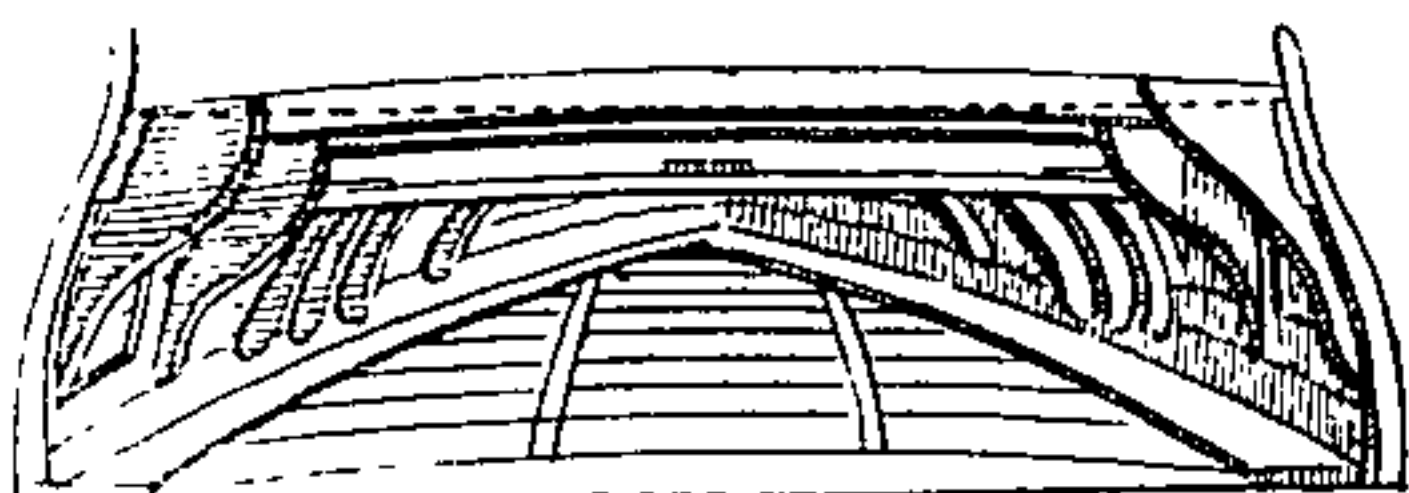
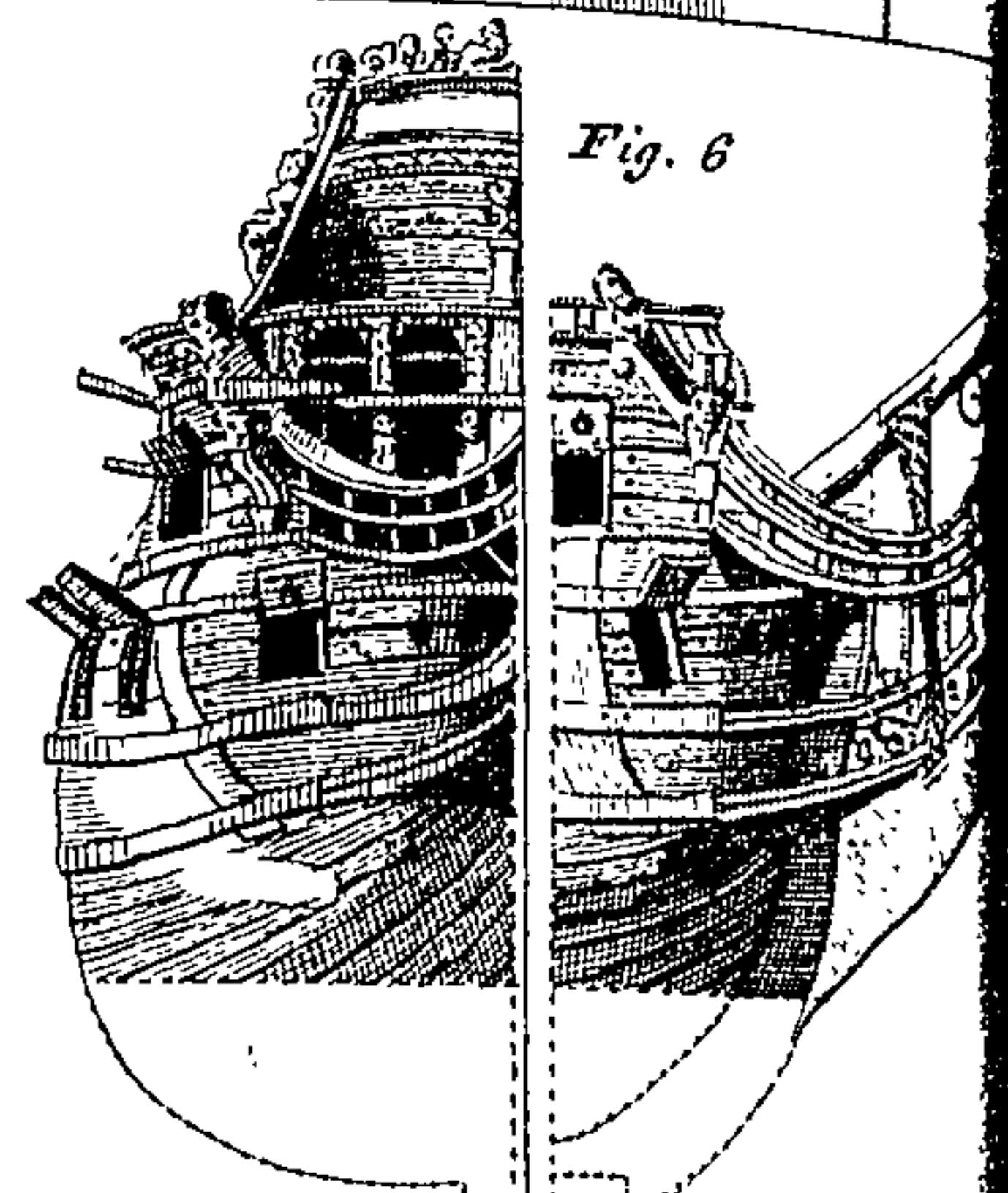
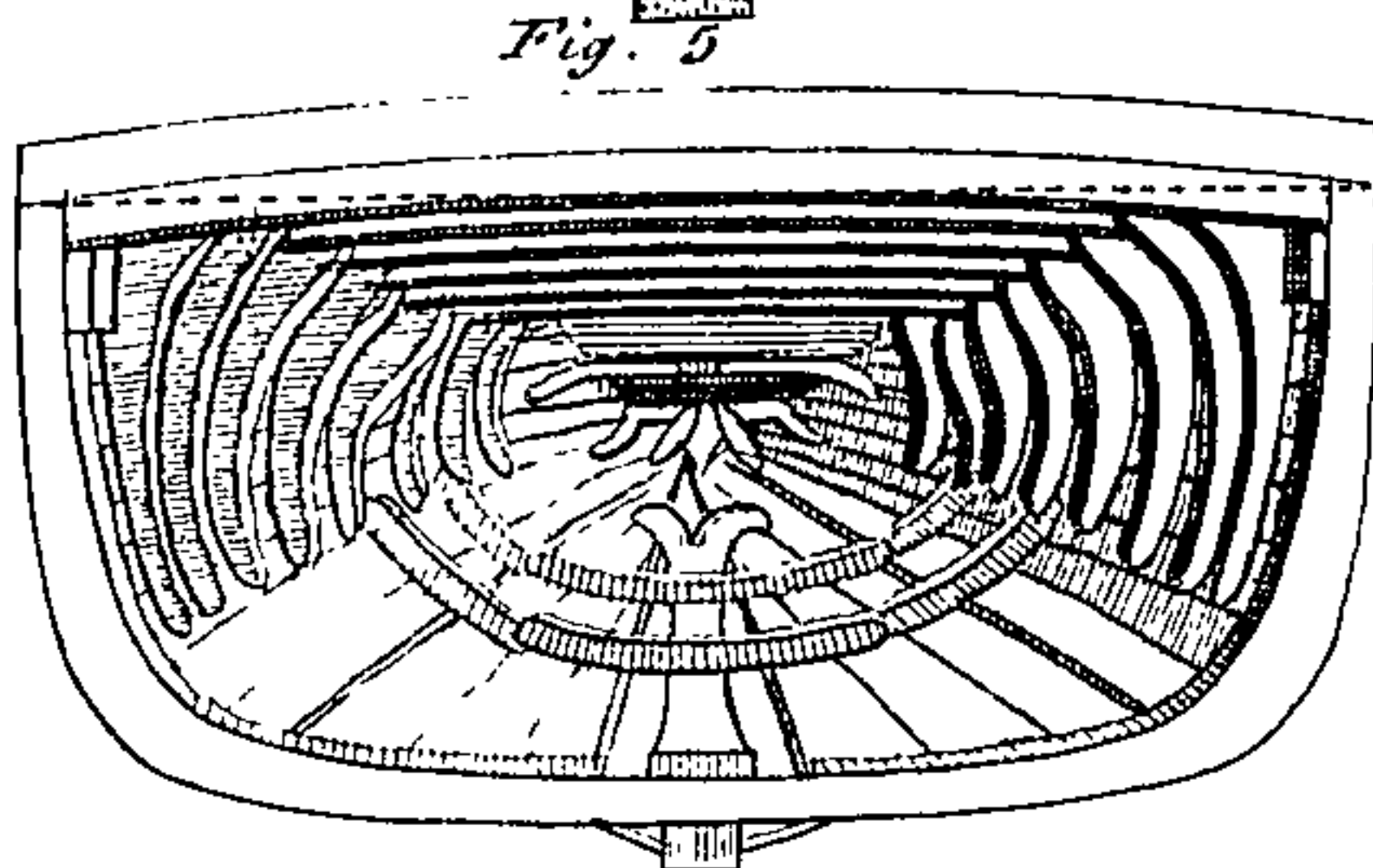
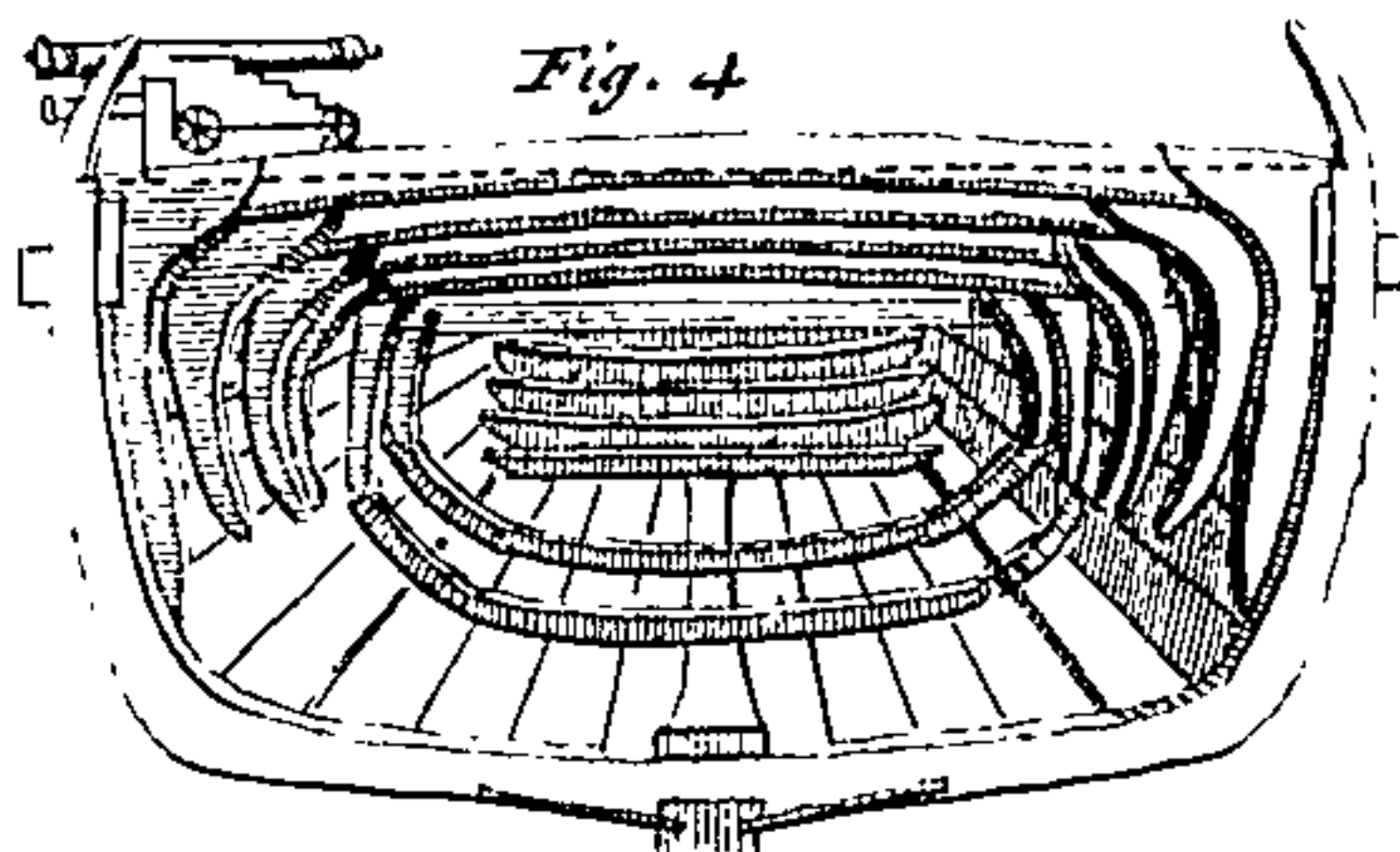
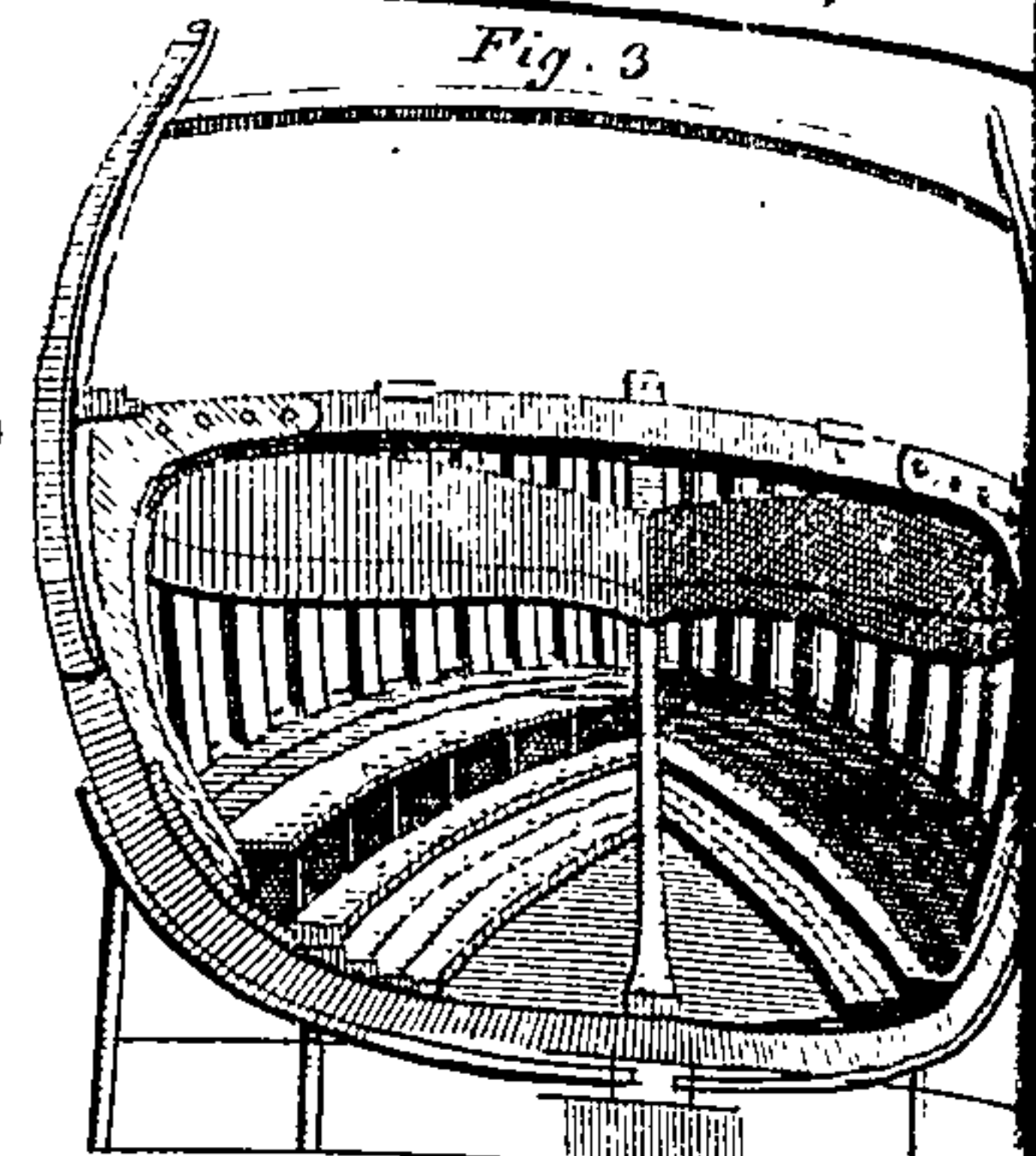
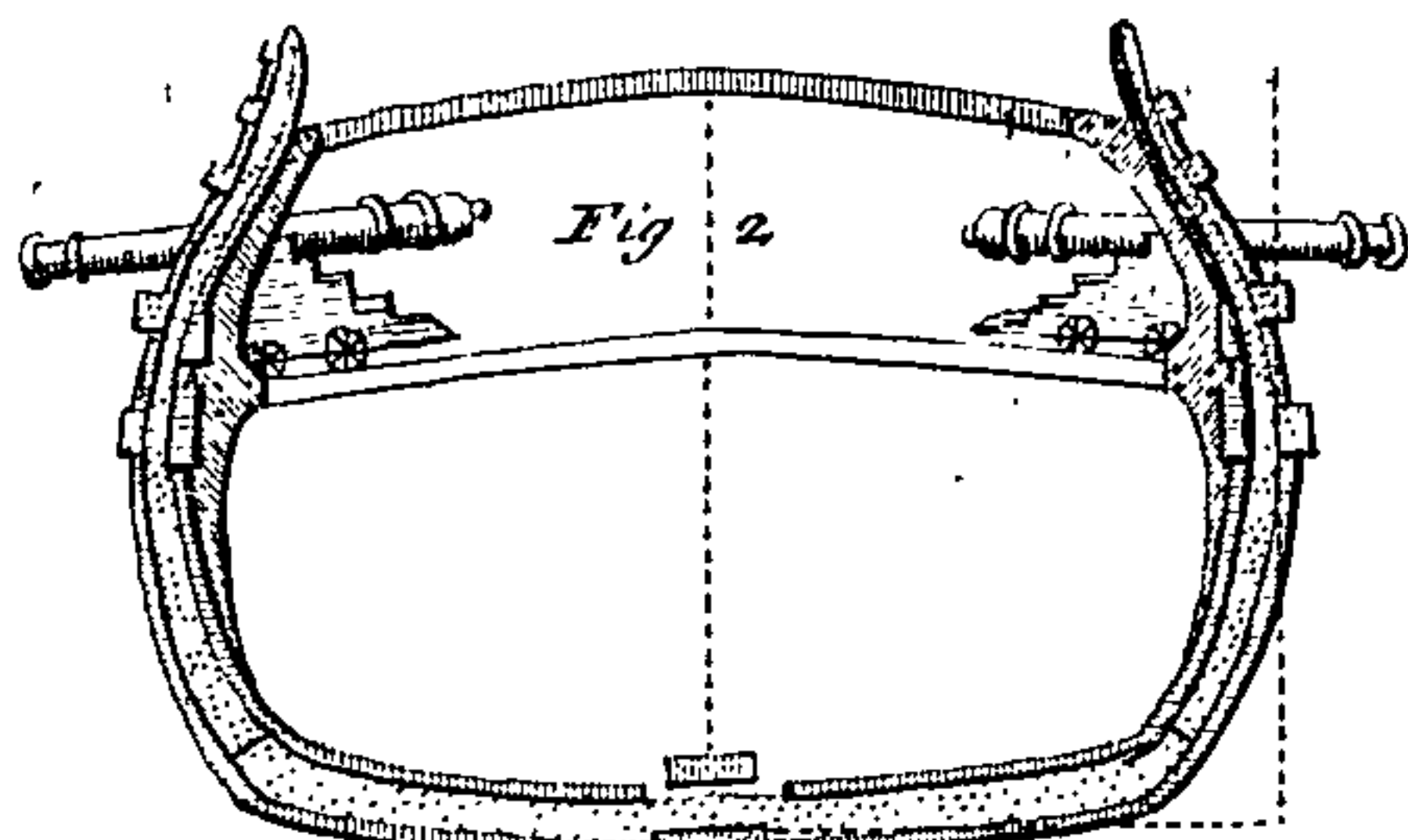
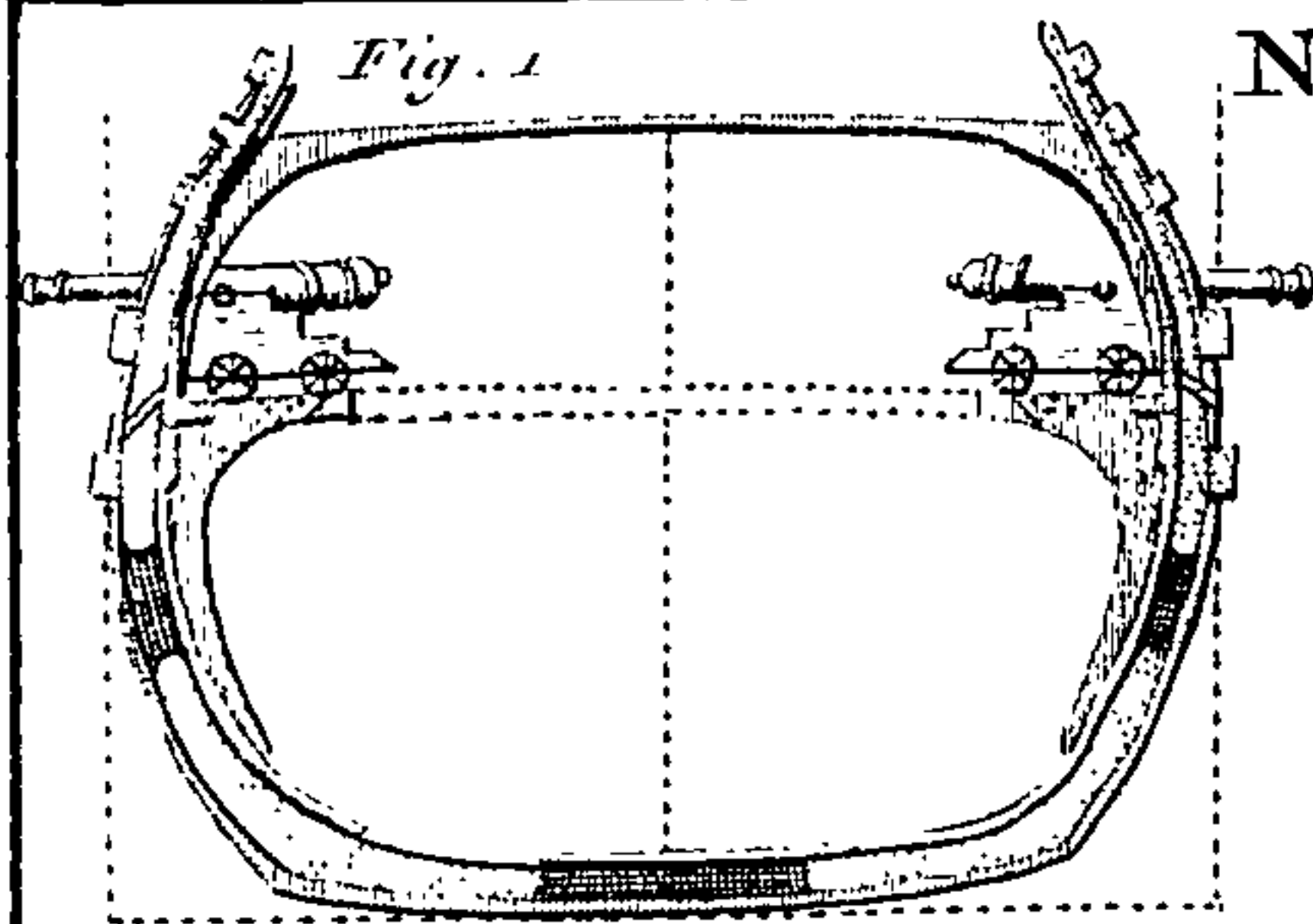
For Fleas bring forth Eggs, or Nits, which they deposit on Animals that afford them a proper Food: These Eggs being very round and smooth, usually slip straight down, unless detained by the Piles, or other Inequalities of the Cloaths, Hairs, &c.

Of these Eggs are hatched white Worms, of a shining Pearl-colour, which feed on the scurfy Substance of the Cuticle, the downy Matter gather'd in the Piles of Cloaths, or other the like Excrement.

In a Fortnight they come to a tolerable Size, and are very lively and active, and if at any Time disturbed, suddenly roll themselves into a Kind of Ball.

Soon after they come to creep, after the Manner of Silk-worms that have no Legs, with a very swift Motion.

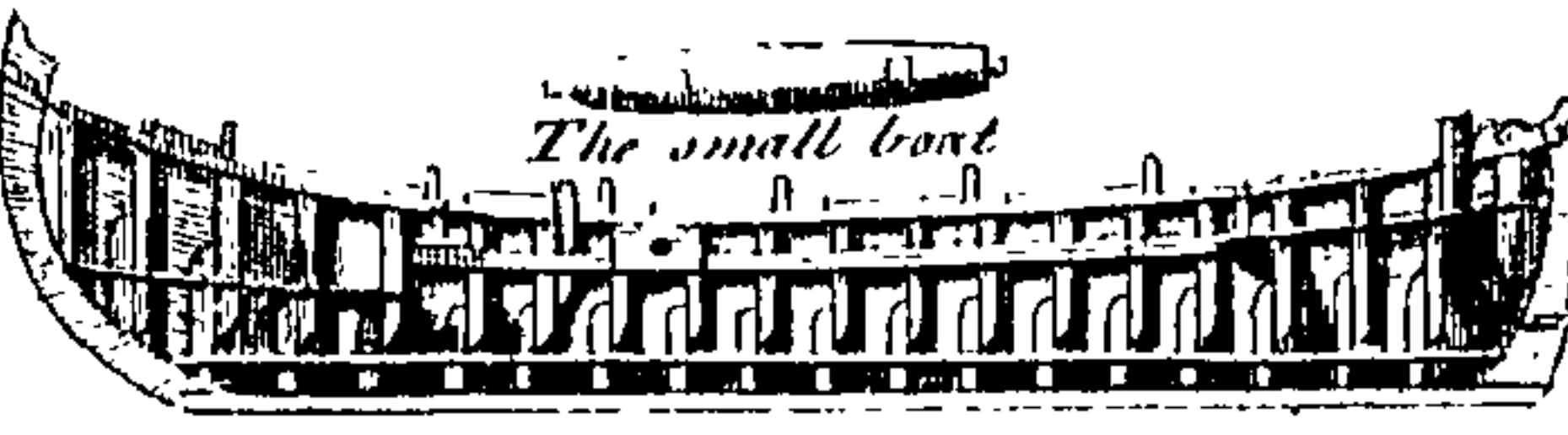
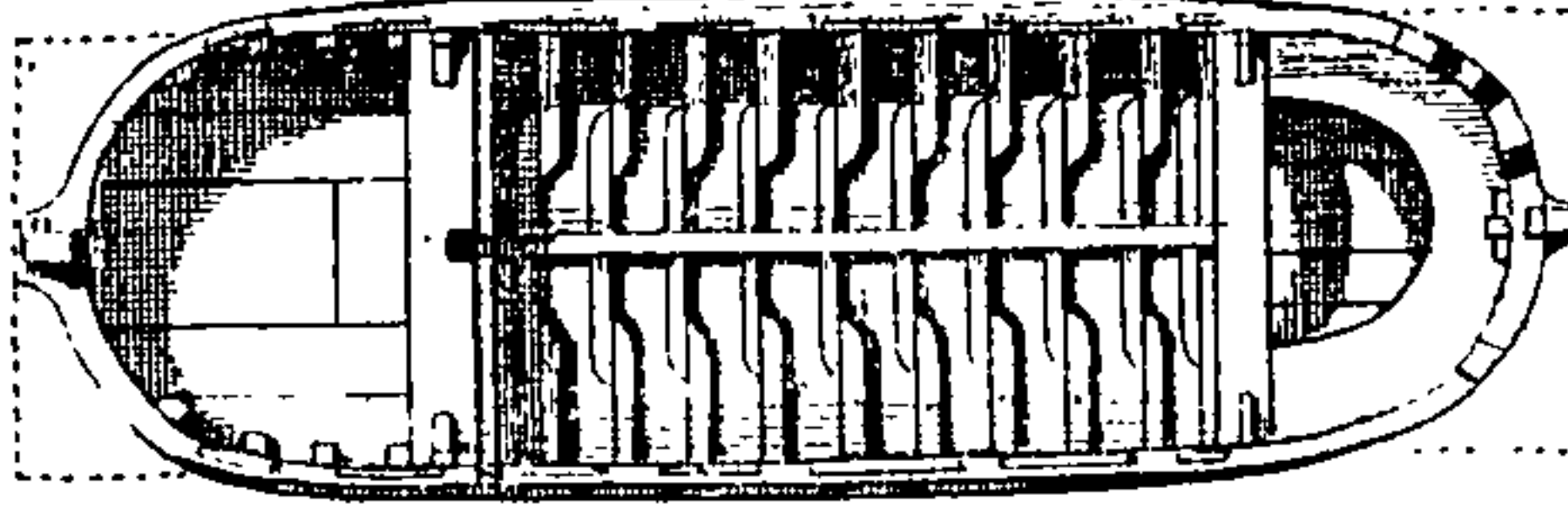
NAVAL ARCHITECTURE



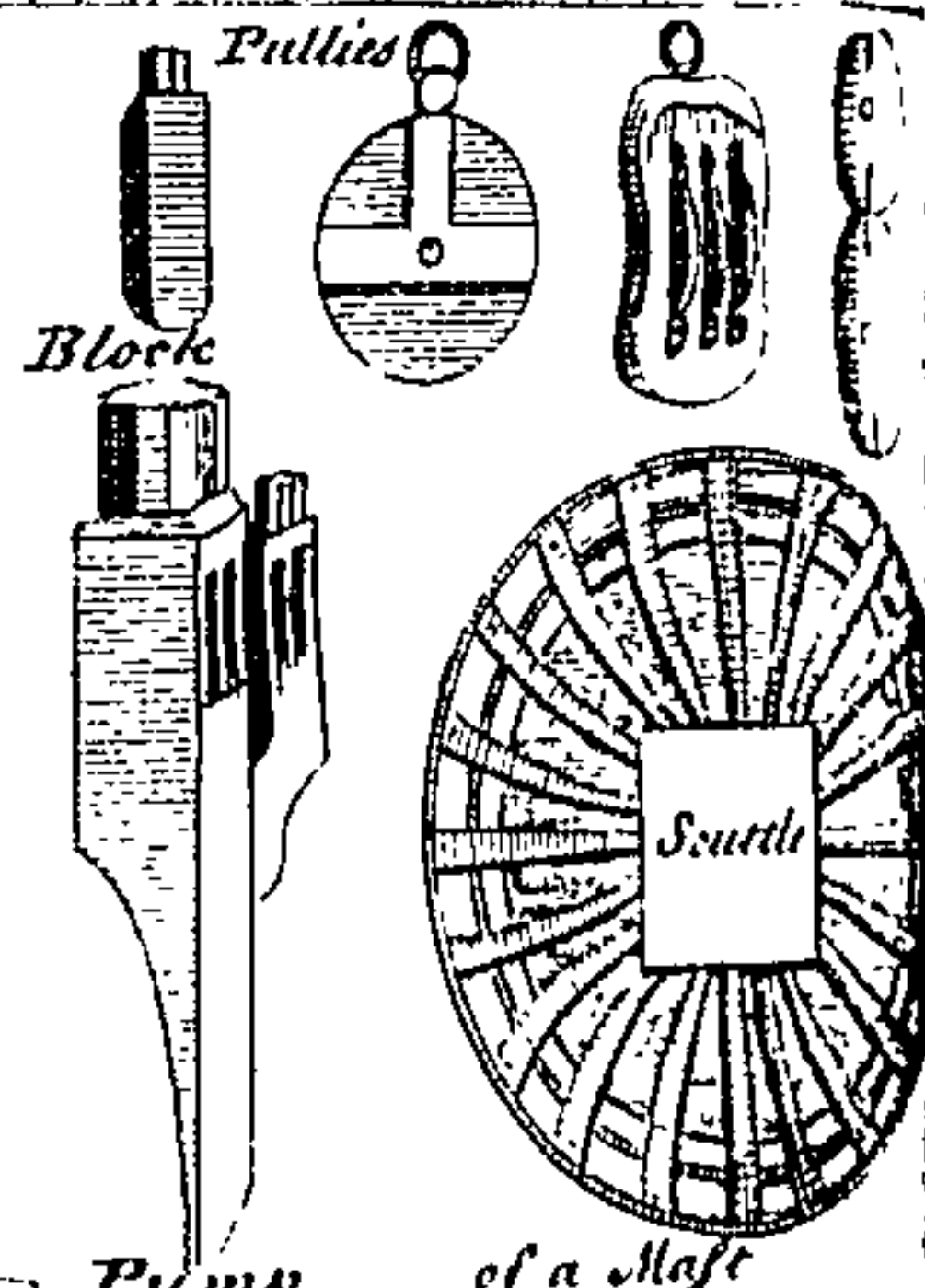
The inside of the great boat

The great boat

The inside of the small boat

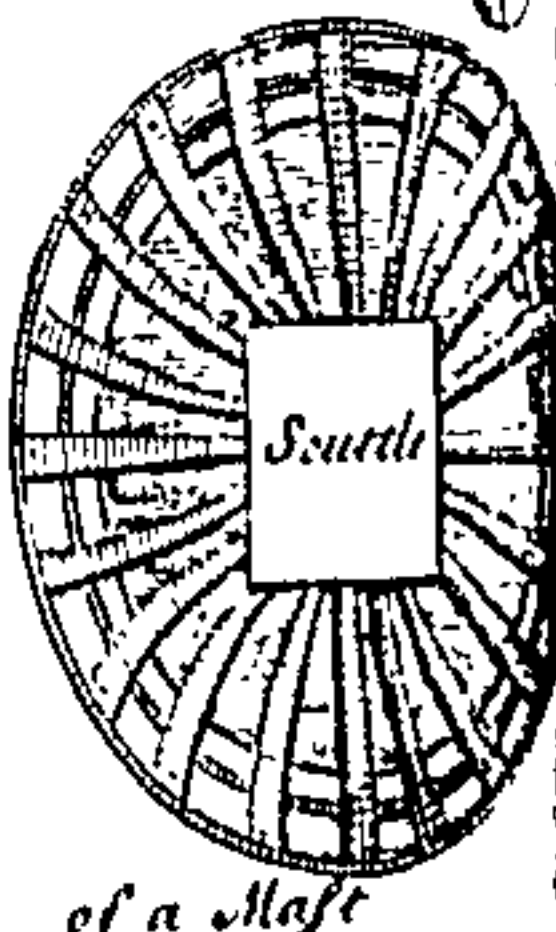


The small boat



Pullies

Block

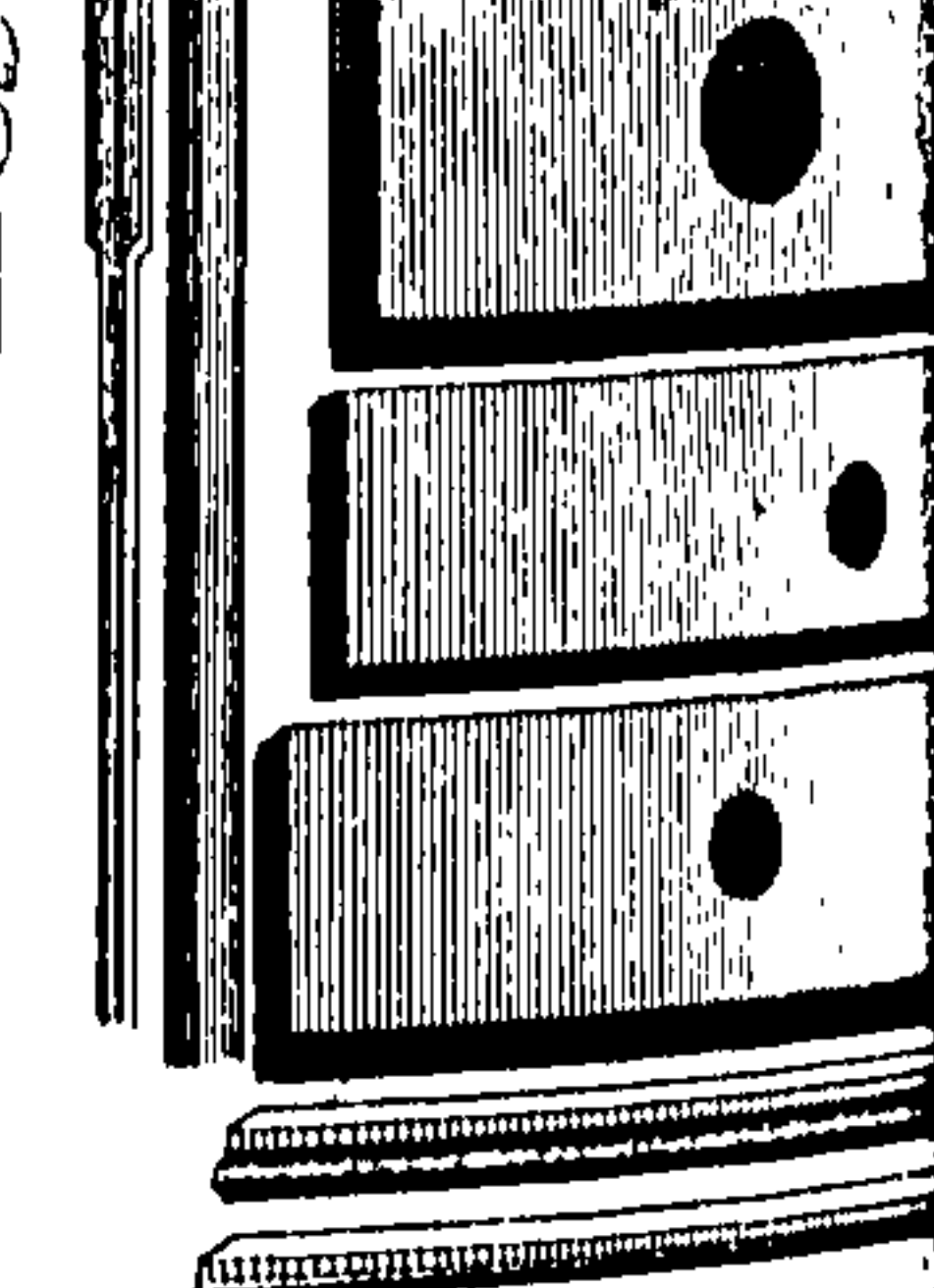


Scuttle

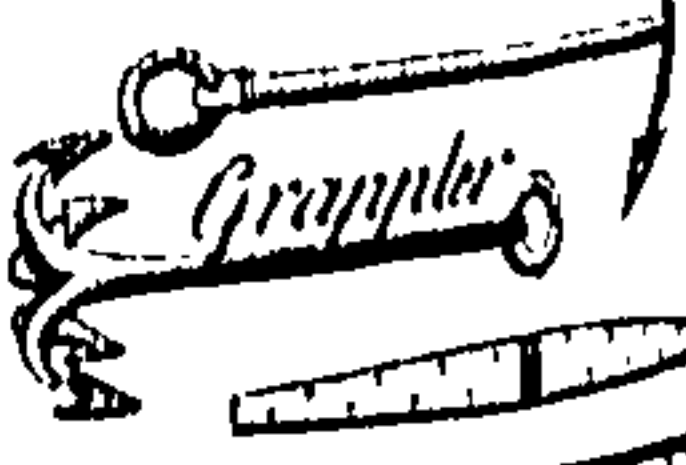
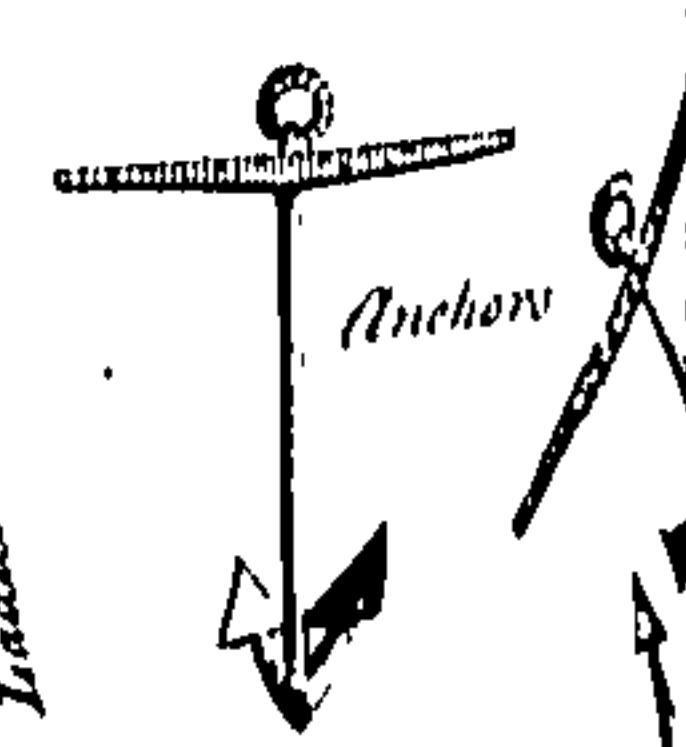
Pump

of a Mast

Fig. 16



Ladder of the Pump



Grapple

Anchor

Mast

Capstern

Great

Fig. 15

Fig. 14

Fig. 13

Fig. 12

Fig. 11

Fig. 10

Fig. 9

Fig. 8

Fig. 7

Fig. 6

Fig. 5

Fig. 4

Fig. 3

Fig. 2

Fig. 1

tion. When arrived at their Size, they hide themselves as much as possible, and spin a filken Thread out of their Mouth, wherewith they form themselves a small round Bag or Case, white within, as Paper; but without always dirty, and fouled with Dust.

Here, after a Fortnight's Sleep, the Animalcule bursts out, transformed into a perfect Flea, leaving its Exuvia in the Bag. While it remains in the Bag it is Milk-white, till the second Day before its Eruption, when it becomes coloured, grows hard, and gets Strength; so that upon its first Delivery it springs nimbly away.

We have so often made mention of *Animalcule*, in the Course of this Treatise, that it is very proper I should say something of it in a more particular Manner.

ANIMALCULE, *Animalculum*, is a Diminutive of Animal, and expresses such a minute Creature, as is scarce, or not at all discernable by the naked Eye.

Such are those numerous Insects which crowd the Waters in the Summer-Months, changing it sometimes of a deep or pale red Colour, sometimes a yellow, &c. they seem to be of the Shrimp Kind, called by *Swammerdam*, *Pulex aquaticus arborescens*. The Cause of their Concourse at this Time, Mr. *Derham* observes, is to perform their Coit. He adds, that they afford a comfortable Food to many Water-Animals. The green Scum on the Top of stagnant Waters is nothing else but prodigious Numbers of another smaller Order of *Animalcules*; which in all Probability serve for Food to the *Pulices aquatici*.

The Microscope discovers Legions of *Animalcules* in most Liquors, as Water, Wine, Brandy, Vinegar, Beer, Spittle, Urine, Dew, &c. In the *Philosophical Transactions*, we have Observations of the *Animalcules* in Rain-Water, in several chalybeate Waters, Infusions of Pepper, Ivyberries, Oats, Barley, Wheat, &c.

The human Seed has been observed by divers Authors to contain huge Numbers of *Animalcules*, which gave Occasion to the System of Generation *ab animalculo*.

Note, That *Leaves* may also claim a Place in this Treatise; therefore,

LEAF, is a Part of a Plant, ordinarily very thin and flat, growing in the Spring, and falling off in Autumn.

As to the Structure of *Leaves*, Dr. *Green* observes, that their Fibres never stand on the Stalk on an even Line, but always in an angular or circular Posture, and their vascular Fibres or Threads are 3, 5, or 7. The Reason of which Position is for their more erect Growth, and the greater Strength of the *Leaf*.

Another Thing observable in the Fibres of *Leaves*, is their orderly Position, so as in some to take in an eighth Part of a Circle, as in Mallows; in some a tenth, but in most a twelfth.

The same Author observes six several Parts, intended by Nature for the Preservation of Gems, viz. *Leaves*, *Surfoils*, *Interfoils*, *Stalks of Leaves*, *Hoods*, and *Mantlings* that cover them.

The Skin or Coat of the *Leaves*, is no more than that of the Branches extended, as Gold, by beating, is reduced into *Leaves*. In the Gem the Leaves are folded, sometimes in two, and sometimes in several Plaits, somewhat after the Manner of a Fan. If the Leaves be too thick to plait commodiously in two, and to be ranged against each other; or if they be in too small a Number, and their Fibres too delicate, instead of being plaited they are rolled up, and form either a single Role, as the *Leaves* of the mountain Cowslip, which are thick; or two Rolls, which begin at each Extremity of the *Leaf*, and meet in the Middle. There are also some Plants whose *Leaves* form three Rolls, as Fern; several

Leaves are covered with Hair of several Figures; those of Lavender and Olive-tree, have Hairs resembling Stars.

Botanists consider the *Leaves* of Plants, with regard to their Structure, Surface, Figure, Consistence, Edges, Situation and Size.—With regard to their Structure, *Leaves* are either *single*, as those of the Apple-tree, Pear-tree, &c. or *double*, as those of Angelica, Parsley, &c.—With regard to their Surface, *Leaves* are either *flat*, as the *Nummularia*, *Asarum*, *Origany*, *Androsænum*, *Brionia Canadensis*, &c. or *hollov*, as those of the Onion and Asphodel; or in *Bunches*, as several Kinds of Kali, and House-Leeks.—With regard to their Consistence, *Leaves* are either thin and fine, as those of St. Johnwort, and Dog's Grass; or thick and gross, as those of Portulaca; or fleshy, as those of several Kinds of House-leeks; or woolly, as those of the Wool-blade.—With regard to the Verge or Edges, *Leaves* are either cut slightly, as some Species of Gum, and *Cannabis lutea*; or deep, as Trefoil, &c.—With regard to their Situation, *Leaves* are either alternate, that is, ranged alternately, as the *Philyca*; or opposite to each other, as the *Philyria*, and some Species of the *Rubia*.—With regard to their Size, *Leaves* are either very big, as those of the *Colonia*, and *Sphondylium*; moderate, as those of the *Bistorte*, the Fig-tree; small, as those of the Apple-tree, Pear-tree, Peach-tree, or very small, as those of *Millepertuis*, or St. Johnwort.

There are likewise, annual, crenated, dissimilar, procumbent, segment, feminal, and vernal *Leaves*.

Annual Leaves, are such *Leaves* as come up afresh in the Spring, and perish in the Winter.

Crenated Leaves, are such *Leaves* as are jagged or notched.

Dissimilar Leaves, denote the two first *Leaves* of any Plant, at its first shooting out of the Ground.

They are thus called, because they usually are of a different Form from the common *Leaves* of the grown Plant.

These Dr. *Green* observes to be nothing but the very Lobes of the Seed expanded, and thus advanced. Their Use is for the Protection of the Plumule; which being young and tender, is thus guarded on each Side, and has also some Rain and Dew, gradually conveyed down to it by this Means.

Procumbent Leaves, are such *Leaves* as lie flat, and trailing on the Ground.

Segment Leaves, is a Denomination given to those *Leaves* that are cut and divided into many Shreds, or Slices, as Fennel, &c.

Vernal Leaves, are those *Leaves* which come up in the Spring.

Besides *general natural Histories*, as those of *Pliny*, &c. there are particular ones, and that of two Kinds. The first those which consider one Kind of Things, such as the History of Shells, by Dr. *Lister*; of Fishes, by *Willoughby*; that of Birds, by the same; that of Plants, by *Ray*; those of Insects, by *Swammerdam* and *Mouffet*; that of Animals by *Gesner*; that of Fossils, by *Agricola*, *Mercatus*, &c.

The second, those which consider the several Kinds of natural Things found in particular Countries, or Provinces; as the *natural History of Dauphiné*, by *Chorier*; the *natural History of the Antilles*, by *F. du Tortre*, and *M. Louvillers de Poincy*; those of *Oxfordshire* and *Staffordshire*, by Dr. *Plott*; that of *Lancashire*, by *Leigh*; of *Northamptonshire*, by *Morton*; and that of the same County, extracted from Mr. *Bridges*; that of the *Western Islands*, by *Martin*, &c.

NAVAL ARCHITECTURE.

NAVAL ARCHITECTURE, or *Ship-Building*, is that which teaches the Construction of Ships, Gallies, and other floating Vessels for the Water; with Ports, Moles, Docks, &c. on the Shore.

A *Ship*, is defined by the *Sieur Aubin*, a Timber-

Building, consisting of various Parts, or Pieces, nailed and pinned together with Iron and Wood, in such Form as to be fit to float, and to be conducted by Wind and Sails from Sea to Sea.

Ships, are usually divided into three Classes; *Ships of War*,

War, Merchant-Ships, and an intermediate Kind, half War, half Merchant; being such, as though built for Merchandize, yet take Commissions for War.

Ships of War, are again divided into several Orders, called *Rates*; which are ordinarily six, viz. *First, Second, Third, Fourth, Fifth, and Sixth Rate*; the *Rate* being usually accounted by the Length and Breadth of the Gun-Deck; the Number of Tons, and the Number of Men and Guns the Vessel carries.

A *First RATE English* Man of War, has its Gun-Deck from 159 to 174 Feet in length; and from 40 to 50 Foot broad, containing from 1313 to 1882 Tons; has from 706 to 800 Men; and carries from 96 to 110 Guns. — A *French* Man of War of that Rate, has from 1000 to 1200 Men.

Second RATE Ships have their great Deck from 153 to 165 Foot long; and from 41 to 46 broad; they contain from 1086 to 1482 Tons; and carry from 524 to 640 Men; and from 84 to 90 Guns. — A *French* Ship of the same Rate, carries from 900 to 1000 Men.

Third RATES, have their Gun-Deck from 142 to 158 Foot in length; from 37 to 42 Foot broad; they contain from 871 to 1262 Tons; carry from 389 to 476 Men; and from 64 to 80 Guns.

Fourth RATES are in length, in the Gun-Deck, from 118 to 146 Foot; and from 29 to 38 broad; they contain from 448 to 915 Tons; carry from 226 to 346 Men; and from 48 to 60 Guns.

Fifth RATES, have their Gun-Deck from 100 to 120 Foot long; and from 24 to 31 broad; they contain from 259 to 542 Tons; carry from 145 to 190 Men; and from 26 to 44 Guns.

Sixth RATES, have their Gun-Deck from 87 to 95 Foot long; and from 22 to 25 Foot broad; they contain from 152 to 256 Tons; carry from 50 to 110 Men; and from 16 to 24 Guns.

Note, That the new-built Ships are much larger, as well as better than the old ones of the same *Rate*; whence the double Numbers all along; the larger of which expresses the Proportions of the new-built Ships, as the less those of the old ones.

Merchant-Ships are esteemed by their Burthen, that is, by the Number of Tons they bear; each Ton reckon'd at 2000 Pounds Weight. The Estimate is made by gauging the Hold; which is the proper Place of Loading.

Note, That as a Man of War of the first Rate, is the most magnificent and most lightly Piece of *Naval Architecture*, we'll begin this Treatise by a Description of all the Parts it is composed of, and afterwards inform our Pupil Ship-builder how to set all those Parts together, in order to form of them a compleat Building; teaching him, likewise, every Thing else that belongs to this excellent and very useful Art.

The different Parts of a *Man of War* (and in Fact almost all other Ships with three Masts) are as follows.

The *Keel*, the *Stern-Post*, the *Rudder*, the *Buttock of the Ship*, the *Gallery*, the *Freeze*, the *Ensign-Staff*, and its *Block*, the *Dunette*, or highest Part of the Stem of the Ship, the *Half-Deck*, or *Corps de Guard*, which is commonly that Part under the *Hind Castle*, the *Fore Castle* or *Prow*, the *Belt Hooks*, the *Cut Water*, the *Cannon*, the *Port Holes*, the *Laver*, and *Upper Check*, the *Trail Board*, the *Figure*, the *Grating*, the *Brackets*, the *Main Stem*, the *False Stem*, the *Hasse Hole*, out of which runs the Cable, the *Cable*, the *Buoy*, and its *Orin*; the *Mizzen Mast*, the *Main Mast*, the *Fore Mast*, the *Bowsprit*, the *Mizzen Top*, the *Main Top Mast*.

Note, That as all the three *Masts* have each their particular Rigging, I must give here the Description of every one of them in particular, before I proceed further; beginning by the Definition of a *Mast*.

A *MAST* is a large Pole, or long Piece of round Wood, raised in Vessels, for the Yards and Sails to be fastened to, in order to their receiving the Wind necessary for Navigation.

In large Vessels, as already observed, the Number of *Masts* is three; or four if we reckon the *Bowsprit*, viz. the *Main-Mast*, the *Fore-Mast*, the *Mizen-Mast*, and the

Bowsprit. To which some add a fifth, viz. a *Counter-Mizen*, which is very seldom used.

The *Fore-Mast* is between the *Main-Mast* and the *Head*.

The *Mizen-Mast* is between the *Main-Mast* and the *Stern*.

The *Bowsprit* lies upon the *Beak*, in the *Prow* or *Head* of the Ship.

The *Counter-Mizen*, in large Vessels and Gallions is in the *Stern*.

We also use the Word *Mast* to signify those Divisions, or additional Pieces in the *Masts* placed over one another.

The *Main-Mast* and *Fore-Mast*, have each of them two, viz. the *Main-Mast* has the *Main-Top-Mast*, called in *French*, *Le Mast de bune*; and the *Main-Top-Gallant-Mast*, in *French*, the *Peroquet de bune*. The *Fore Mast*, has the *Fore-Top-Mast*, called in *French*, *La petit bune*, and the *Fore-Top Gallant-Mast*, in *French*, *Le Peroquet de Mizene*.

The *Mizen-Mast*, called in *French*, *Le Mast d'Arion* has but one, viz. the *Mizen-Top-Mast*, in *French*, *Peroquet de Fougue*.

The Rigging of the *Main-Mast*, are the *Runners* and *Tackles*; the *Tackle*, the *Shrowds* and *Laniards*, the *Stay* and *Sail*, the *Stay-Sail Halliards*, the *Yard* and *Sail*, the *Jeers*, the *Sheets*, the *Tacks*, the *Buntlines*, the *Bowlines*, the *Braces*, the *Leach Lines*, the *Puttock Shrowds*, the *Crowfoot*, the *Lifts*, the *Top*, the *Top Armour*, the *Top Rope*, the *Cap*, the *Main-Yard Tackles*.

The Rigging of the *Main-Top-Mast*, are the *Tackles*, *Shrowds*, *Back-Stays*, *Halliards*, *Stay* and *Sail*, *Stay Sail Halliards*, *Yard* and *Sail*, *Braces*, *Bowlines*, *Sheets*, *Clewlines*, *Lifts*, *Runner*, *Buntlines*, *Cross-trees*, *Cap*, *Stump*, *Stay*, *Truck*, *Pendant*.

The Rigging of the *Fore-Mast*, are the *Runner* and *Tackles*, the *Tackle*, *Shrowds* and *Laniards*, *Stay*, *Yard* and *Sail*, *Sheets*, *Tacks*, *Braces*, *Bowline*, *Buntlines*, *Leachlines*, *Yard Tackle*, *Jeers*, *Puttock Shrowds*, *Crowfoot*, *Lop*, *Top Armour*, *Top Rope*, *Lifts*, *Cap*.

The Rigging of the *Fore-Top-Mast*, are the *Tackles*, the *Shrowds*, the *Back-Stays*, *Halliards*, *Stay* and *Sail*, *Halliards*, *Yard* and *Sail*, *Runner*, *Lifts*, *Braces*, *Bowlines*, *Sheets*, *Clewlines*, *Buntlines*, *Cross-trees*, *Cap*, *Stump*, *Stay*, *Truck*, *Spindle*, *Vane*.

The Rigging of the *Mizen-Mast*, are the *Yard* and *Sail*, the *Sheet*, *Shrowds* and *Laniards*, *Bowlines*, *Brayles*, *Jeer*, *Peak Halliards*, *Cross Jack Yard*, *Lifts*, *Braces*, *Puttock Shrowds*, *Mizzen-Top*, *Top Armour*, *Cap*, *Crowfoot*, *Stay* and *Sail Halliards*.

The Rigging of the *Top-Mast*, are the *Yard* and *Sail*, *Braces*, *Lifts*, *Shrowds*, *Halliards*, *Back-Stays*, *Bowlines*, *Sheets*, *Clewlines*, *Stay*, *Cross-trees*, *Cap*, *Stump*, *Stay*, *Truck*, *Spindle*, *Vane*, *Slings of the Cross Jack Yards*.

The Rigging of the *Bowsprit*, are the *Horse*, *Yard* and *Sail*, *Lifts*, *Sheets*, *Clewlines*, *Braces*, *Bobstay*, *Top*, *Top Armour*.

The *Sprit-Sail*, *Top-Sail*, and the Rigging of the *Top-Mast*, are the *Shrowds*, *Halliards*, *Crane Line*, *Yard* and *Sail*, *Braces*, *Lifts*, *Sheets*, *Cross-trees*, *Cap*, *Jack-Staff*, *Truck*, *Jack*, *Best Bower Buoy*, and the *Cable*.

Note, That all these Terms, and their different Use, will be explain'd in a more ample Manner, in the Course of this Treatise, and in the Places where I'll treat of the Construction of the different Parts of a *Ship*, and of their Proportion with regard to the different Sorts of Vessels. — But to proceed on the *Draw*, or *Plot* for building a Man of War; therefore,

A *Man of War*, which has its Gun-Deck 128 Feet long, must have 13 Feet in Depth, 32 Feet in Breadth, and 110 Feet of Keel bearing on the Ground.

The main Stem ought to be 24 Feet high, and the *Stern-post* 24 Feet likewise.

The *Main-Mast*, must be 82 Feet long; the *Fore-Mast*, 72 Feet; the *Mizen-Mast*, 61; the *Bowsprit*, 48.

The *Main-Top-Mast*, 52 Feet six Inches; the *Main-Top-Gallant*, 24 Feet; the *Fore-Top-Gallant*, 20; the *Mizen Top-Mast*, 26, 6 Inches; the *Bowsprit-Top-Mast*, 17 Feet.

The *Main-Yard* ought to be 70 Feet long; that of the

the *Fore-Mast*, 60; that of the *Mizen-Mast*, 64; that of the *Main-Top-Mast*, 40; that of the *Fore-Top-Mast*, 5 Feet, 5 Inches; the *Bowsprit-Yard*, 15 Feet.

The Head must be 20 Feet long; the *Putlocks* of the *great Shrouds*, 25 Feet; those of the *Shrouds* of the *Fore-Mast*, 21; and those of the *Mizen-Mast*, 12 Feet.

The *Scuttle* of the *Main-Mast* must be 13 Feet broad Cross-wise; that of the *Fore-Mast*, 11 Feet, 6 Inches; and that of the *Mizen-Mast*, 7 Feet. The *Gallery* must be 8 Feet long.

Note, That the Proportion of the three principal Pieces marked above, can be a Rule for all the other principal Members of a Ship; and that by increasing or diminishing the Proportions of those three Pieces, one can likewise increase, or diminish the others in Proportion; so that it may serve of Model for the whole Construction of Ships of all Bigness. But however, to enter into a still more particular, and clearer Detail of all the preceding Articles, I'll shew in this Place how, by means of the Length proposed of a Ship, one can find the just Measure of its principal Parts.

When once the Length of a Ship has been found or proposed, one must take for its Breadth a Quarter of its Length, so that a Ship 120 Feet long, from the *Main-Stem* to the *Stern-Post*, will give 30 Feet in Breadth, *i. e.* one Third of its Length. This notwithstanding is not a general Rule; for very often something more, or something less than a Quarter of the Length, is given for the Breadth. And the modern Method is to give more than a Quarter of the Length for the Breadth of a Ship, because it is pretended that they sail better. For Merchant-Ships, something less than their Length is given for their Breadth, that they may more easily play on their Anchor, and not want so large a Complement of Men.

When the Breadth of a Ship is regulated, one must search the Depth to be given to it. Every six Feet of Length must give it one Foot of Depth, which notwithstanding we see some Ships where that Method has not been observed; because some of them have 4 Feet more in Breadth than that Proportion; others have two Feet less, but that's very rare.

This Article once regulated, one proceeds to the *Keel*, which must be a Quarter thicker than the *Main-Stem* inside; and its greater Breadth taken likewise, at the greatest Width of the Ship, because at both Ends the *Keel* must be equal to the *Main-Stem*, and to the *Stern-Post*; its greater Breadth must be once and a half more than that of the *Main-Stem*. The *Side-Planks* must be in Thickness, one Quarter of the Thickness of the *Main-Stem*.

For the Thickness of the *Main-Stem* Inside, we give it one Inch for every 10 Feet of the Length of the Ship; so that 120 Feet in Length, give a Foot and an Inch Thickness to the *Main-Stem* Inside, and full 7 Inches Outside; because one commonly takes three Fifths of its Thickness Inside, for its Thickness Outside. To have the Height thereof; the Depth, the rising up, and the Height of the *Fore-castle*, must be joined together. For Instance, 10 Feet in Depth, two of rising up, and to find that Height of the rising up, every 10 Feet of the Length of the Ship must give full two Inches and a half for the rising up of the *Fore-part*, and six Inches and a half for the rising up the hind-part, and six Feet in Height between Decks, taken at the Side, the whole making up together 18 Feet, which Height must be that of the *Main-Stem*; though the *Flutes* must have less, and the *Frigates* more. When the Height of the *Main-Stem* is found, one must observe, if there will be a *Fore-castle*, and if there is to be none, the *Main-Stem* must be lower, of about three Feet and a half at least. The Roundness of the *Main-Stem* depends on the Inclination and good Taste of the *Ship-builder* or *Constructor*.

The Depth, the rising up, and all that's above it, must also be taken and joined together, for the Height of the *Stern-Post*. Its Thickness Inside and Outside is equal to that of the *Main-Stem*.

The *Main-Stem*, must have in its Middle three times as much Width as it has Thickness, and have likewise

upwards and downwards, more Width than Thickness. Its Thickness like that of the *Stern-Post* must be a little less than that of the *Keel*. The *Side-Planks* must be fixed into the *Main-Stem*, at a Quarter of its Thickness Inside.

The Length of two Thirds of that of the Ship is given to the *Tillard*, and as many Inches of Thickness, Breadth, and Roundness, as it has Feet in Length. The *Transoms* of the *Stern* have commonly as much Length above the *Tillard* as the *Stern-Post* is long.

For the Construction of the *Buttock* of the Ship, the *Stays* must be in Length half that of the *Stern-Post*, taken Inside, and must have the five sixth Parts of the Thickness; notwithstanding which, in Ships of Burthen they are placed lower than they are in *Frigates*; they must have in Breadth double that of the *Tillard*, and their Bending must be very near round-wise. The Bars of *Counter-buttock* must have in Thickness one Fifth, at least, of that of the *Stern-Post*, and the Spur must have but an Inch less than the *Stern-Post*. They give to the *Transoms* of the *Stem*, two Thirds of the Thickness of the *Stern-Post*; and downwards their Binding must agree with that of the *Stays*. There must be as much Distance between every one of the Ends upwards, as the three Fifths of the Bar of the *Buttock* make up in Length. The *Side-Planks* are proportioned according to the Reverse given to the *Transoms*.

To find the Breadth of the *Taffarel*, one takes two Thirds of the whole Breadth of the Ship, under the *Scoper-Holes*; so that 25 Feet in Breadth, give 16 Feet, 7 Inches and half for the Breadth of the *Taffarell*. Each Foot of the Breadth of the *Taffarell* gives likewise half an Inch of Roundness at the Bottom of the *Great Drought*. The rest on each Side of the Ship, as far as the *Scoper-Holes*, must be risen by the Equality of the *Drought*.

When one gives to a Ship more Width than that above prescribed, he must give to the last *Side-Plank* of the Bottom a little more Roundness than to the others, that its *Gabarit* may agree better with that of the *Flowers*, and be more agreeable.

The Roundness of the *Flowers* must be a Third of the Arch, every ten Feet of the Length of the Ship, make the *Flowers* an Inch narrower, in ascending, on the whole Roundness of the Structure, so that the inverted *Transoms* jut out 16 Inches in the *Side-Planks*.

The *Ribs* of the *Great Gabarit* on the Sides, which rest on the *Keel*, must have three Quarters of the Thickness of the *Keel*, and the Bar of the *Gabarit*, half of its Thickness, as well as the *Transoms* on the Bars, must have two Sevenths of the Thickness of the *Stem* Inside. They are a little lighter, or thinner fore and aft of the Ship, and stronger at the Bottom and Top.

The Pieces of Timber which make the Foundation of the Ground-Floor, must be a little thicker than the *Side-Planks*; but those of the Bottom, and of the *Flowers*, must be a little thinner.

Every 10 Feet of the Length of the Ship, must give an Inch and an eighth Part of an Inch for the Length and Thickness, of the Ledges of the first, and lower Deck; and an Inch for their *Tonture*. Commonly as much Thickness is given to the lower Beams, as the *Stem* has Inside; but only a Third of that Thickness, to the small Beams of the *Dunette*, or highest Part of the *Stem* of the Ship. Very often the *false Sledges* are placed 3 Feet and a half under the other *Sledges*, when these are placed at 13 Feet and a half deep.

The *Tillard* is regulated for its Thickness and Length, by the Bars of the *Stem* Inside; and the Bars of the *Counter-Buttock*, are one Third less thick than the *Tillard*. The *Stays* must have half of the Thickness of the *Stem*; and the *Side-Planks* one Quarter of that of the *Stem*. The *Ribs* must have three Quarters of the Thickness of the *Stem*; the *Knees* half thereof at the *Flowers*, the second *Transoms*, two Fifths; the *Transoms* of *Migrenier*, the *Porques* a Fourth; and the *Carline* two Thirds. The *Ribs* must be in Thickness two Inches less than the *Stem*, half at the *Baloire*, and two Thirds at the *Lats* of the *Gabarit*. The *Transoms* of the *Stern* must be placed as high above the *Tillard*, as the *Stem* is long. Sometimes the *Side-Planks* are made a little thicker than a Quarter of the *Stem*; and the *Tillard* is made as long as the *Taffarel* is broad; and the *Side-Planks* have a

Quarter

Quarter of the Thickness of the Stem.

The lower *Præinte* must have half the Thickness of the Stem, and the whole Thickness thereof for its Length. The *Præintes* above it have a little less. But when Ships are 170, or 180 Feet in Length, *i. e.* from the Main-Stem to the Stern, the upper *Præintes* must be 2 Inches less thick than the lower.

The *Buttocks* of the first *Deck* must have two Thirds of the Thickness of the Main-Stem; and those of the upper *Deck* one Fourth only.

The *Buttocks* of the uppermost Part of the Stern, must have a Third of the Thickness of the Stern; and the *Scoper-Holes*, one Fourth thereof Inside. In large Ships we see sometimes flying Decks of *Gratings*, placed before the *Dunette*, and which may be taken off at Pleasure.

The *Pillars* of the *Bits*, and the *Bolster*, must be one Third thicker than the Stem; but the Head of the *Bolster* must be half thicker.

The great *Chain-Walles* must have in Length one eighth Part of that of the Ship, and of Thickness one Third of that of the Main-Stem. The *Chain-Walles* of the *Fore-Mast* must be a little shorter, thinner, and narrower than those of the *Main-Mast*. The *Chain-Wales* of the *Mizen-Mast* must have but one Third of the Length of those of the Main-Mast; but they are to be as thick as those of the *Fore-Mast*.

The *Hillocks* of the *Hatches*, must be in Thickness one Third of that of the Main-Stem; the Frame which is Inside must have a fifth Part of the Thickness of the said same Main-Stem, the *Malfoles* a Fourth, and the *Bolster* a Third; but the whole must be less in the other smaller *Hatches*.

For every 10 Feet of the Length of the Ship, one must give two Inches and a half of Thickness to the *Capston* a-top, the *Spindles* must have in Length half the Height of the Head of the *Capston*; and the *Holes* a sixth Part of Thickness thereof in Diameter.

The Height between Decks is divided into three Parts, one Part whereof is above the *Port-Holes*, and the other underneath.

In dividing the Ship into five Parts and a half, the *Mizen-Mast* is placed at the End of the first Part, coming forward; the *Main-Mast* at the End of the third Part, and the *Fore-Mast* at the fifth Part. The *Main-Mast* is made shelving in the Hole, one Foot and eight Inches for every ten Feet of the whole Length of the Ship; to the *Fore-Mast* two Inches only, or it is even placed quite upright; and to the *Mizen-Mast* an Inch, likewise for every ten Feet of Height.

Four Inches Breadth are given to the *Rudder*, for every 12 Feet of the Length of the Ship; as for its Height it must be proportioned to that of the *Stern-Post*.

The *Pegs* are an Inch thick, for every hundred Feet the Ship has in Length, and a little less is given to the *Iron Pegs*. The *Nails* are once longer than the *Boards* are thick.

Note, That this is what I have judged necessary, to propose for the Construction of Ships, with regard to the Bigness and Measure which has been established, in which I have endeavoured to follow the Thoughts and Rules of the best Masters. As to what relates to the *Futtocks*, &c. of the Parts and Members of a Ship, such as the *Dunettes Transoms*, it is not possible to prescribe sure Rules, because those Pieces change according to the Use one designs to make of the Ships; but however, the Diminutions must be made slowly, and with Caution.

Note, also, That when the Shell or Body of the Ship, the Measure, and Proportions above described are perfected, one passes to the making thereof, for which I have marked the Places in the Description I have given of the *Carlines*; therefore it remains only to regulate here the Thickness, Height, and Length of the *Masts*.

The Length of the *Main-Mast* is found by taking twice the Depth and Breadth of the Ship joined together. Therefore when the Ship has 12 Feet in Depth, and 29 in Breadth, which make together 41 Feet, the double make 82 Feet, which must be the Height of the

Main-Mast. Its Thickness is regulated by the Depth of the Ship, every six Feet of Depth giving it a Foot of Diameter. At the *Cap* it must have three Quarters of the Thickness it has in the *Etambrie*.

The five Sixths of the Thickness of a Mast, must make the Thickness of a *Top-Mast* in the *Cbouquet*.

The Length of the *Fore-Mast* be seven Eighths of that of the *Main-Mast*, and that of its *Top-Mast* proportioned to it.

The Length of the *Mizen-Mast* must be six Sevenths of that of the *Fore-Mast*; and that of its *Top-Mast* in Proportion.

The Length of the *Main-Yard*, must be twice the Breadth, and once the Depth of the Ship joined together.

The *Yard* of the *Fore-Mast*, must be a Seventh less than the *Main-Yard*.

The *Yard* of the *Mizen-Mast*, must be one Foot or two longer than its Mast.

The Thickness of the *Yards*, must be a little less than a Quarter of the Mast for which they are designed.

The Mast of the *Boltsprit*, must be a little shorter than the *Mizen-Mast*.

The *Yard* of the *Boltsprit*, must be one Quarter shorter than the *Boltsprit*.

The *Yard* of the *Main-Top-Mast*, must be full half shorter than the *Main-Yard*.

The *Yard* of the *Fore-Top-Mast*, must be scarce half shorter than the *Mizen-Yard*.

The *Yard* of the *Top-Gallant* of the *Boltsprit*, must be one Third of the Length of the *Boltsprit*.

But the *Top-Gallant* of the *Boltsprit*, must have one Foot or two more in Length, than one Third of the Length of the *Boltsprit*.

The Length of the *Mizen-Top-Gallant*, must be one Third of that of the *Main-Top-Gallant*, or a little more.

The *Fore-Top-Gallant*, must be one Ninth shorter than the *Main-Top-Gallant*. The *Caps* of the *Masts* are octagones, and a little thicker than the *Masts*, because of the *Cordage* which run through.

The *Scuttles* of the *Masts* are variously regulated, according to the Taste and Experience of the Masters. But in general, for every ten Feet of the Length of the Ship, one gives nine Inches Breadth to the *Main-Scuttle*, and the others are proportioned to it.

Note, That when the Ship is fitted with all its *Masts*, and their Appurtenances; then it must be rigged with all its *Cordages*, to which the following Table will be of Use. In it are seen the Bigness and Diameter of all the principal Tacklings in Proportion to the *Masts* they are to be appropriated; and first, that of the *Cables*.

Weight of Cables of a hundred Fathoms.

| Inches | | Inches |
|-------------------------|--|---------------------------|
| A Cable of 4 weighs 325 | | A Cable of 11 weighs 2150 |
| 4½ — 400 | | 11½ — 2325 |
| 5 — 490 | | 12 — 2550 |
| 5½ — 458 | | 12½ — 2750 |
| 6 — 680 | | 13 — 3000 |
| 6½ — 800 | | 13½ — 3250 |
| 7 — 330 | | 14 — 3500 |
| 7½ — 1060 | | 14½ — 3800 |
| 8 — 1200 | | 15 — 3900 |
| 8 — 1340 | | 16 — 5332 |
| 9 — 1490 | | 17 — 5900 |
| 9½ — 1640 | | 18 — 6600 |
| 10 — 1800 | | 19 — 7000 |
| 10½ — 1970 | | 20 — 8000 |
| | | 21 — 9000 |

Note, That here follows a List of the Length and Breadth of some Ships, and of the Length and Thickness of the *Masts*, and of their Tacklings.

Ships of 142 Feet in Length, and 37 broad,

| | | Diam. | |
|-----------------------------|----|-------|----|
| The Length of the Main-Mast | 88 | | 20 |
| of the Fore-Mast | 78 | | 19 |
| of the Boltsprit | 52 | | 20 |
| of the Mizen-Mast | 69 | | 14 |
| of the Main-Top-Mast | 50 | | 15 |
| of the Fore-Top-Mast | 46 | | 12 |
| of the Mizen-Yard | 74 | | 10 |

| | | | |
|--|-----------------|---------|-----------------|
| The Length of Mizzen-Top Gallant, | 28 | Diam. | 6 |
| of the Main-Top Gallant, | 25 | | 6 |
| of the Fore-Top Gallant, | 21 | | 5 |
| of the Top Gallant of the Bow-sprit, | 18 | | 6 |
| <i>Yards.</i> | | | |
| The Main-Yard, Feet long, | 28 | | 15 |
| of the Fore-Mast, | 24 | | 13 |
| of the Bow-sprit, | 17 | | 8 $\frac{1}{2}$ |
| of the Main-Top-Mast, | 15 | | 8 $\frac{1}{4}$ |
| of the Fore-Top-Mast, | 13 | | 8 |
| of the Top-Gallant of the Bow-sprit, | 10 | | 4 $\frac{3}{4}$ |
| of the Main-Top Gallant, | 9 | | 4 $\frac{1}{2}$ |
| of the Fore-Top Gallant, | 7 $\frac{1}{2}$ | | 3 $\frac{3}{4}$ |
| <i>Rigging or Cordages of the Main-Mast.</i> | | | |
| Stay, | 15 | Inches | 18 |
| Shrowds, | 7 $\frac{1}{2}$ | | 18 |
| Lanniards, | 7 $\frac{1}{2}$ | | 10 |
| Halyard, | 8 | | 29 |
| Tacks, | 7 $\frac{1}{2}$ | | 22 |
| Sheets, | 4 $\frac{1}{2}$ | | 39 |
| Lifts, | 9 | | 29 |
| Runners and Tackles, | 9 | | 37 |
| Leach-Lines, | 26 | Threads | 50 |
| Bowlines, | 16 | | 14 |
| Braces, | 8 | | 35 |
| Buntlines, | 8 | | 28 |
| <i>Foremast.</i> | | | |
| Stay, | 12 | Inches | 13 |
| Shrowds, | 7 | | |
| Lanniards, | 7 | | 9 |
| Tacks, | 7 | | 20 |
| Sheets, | 4 | | 37 |
| Runner and Tackles, | 9 | | 37 |
| Lifts, | 8 | | 27 |
| Halyard, | 7 $\frac{1}{2}$ | Threads | 27 |
| Leach-Lines, | 24 | | 40 |
| Bowlines, | 14 | | 20 |
| Braces, | 7 | | 25 |
| Buntlines, | 7 | | 27 |
| <i>Mizen-Mast.</i> | | | |
| Stay, | 26 | | 12 |
| Shrowds, | 4 $\frac{1}{2}$ | | 12 |
| Brayles of the Top Gallant, | 11 | | 36 |
| Sheet, | 10 | | 25 |
| Runner of Armour, | 21 | Threads | 9 |
| Lifts, | 21 | | 12 |
| <i>Bow-sprit.</i> | | | |
| Halyard, | 4 $\frac{1}{2}$ | Inches | 7 |
| Clew-Line of the Top-Gallant, | 6 | | 14 |
| Sheets, | 7 | | 18 |
| Braces, | 5 | | 19 |
| Halyards, | 6 | | 22 |
| Buntlines, | 5 | | 11 |
| <i>Main-Top-Mast.</i> | | | |
| Shrowds, | 4 $\frac{1}{2}$ | Inches | |
| Tackles, | 4 $\frac{1}{2}$ | | |
| Halyard, | 5 $\frac{1}{2}$ | | 9 |
| Stay, | 26 | | 22 |
| Sheets, | 6 | | 32 |
| Clew-Line | 9 | | 57 |
| Bowlines, | 10 | | 23 |
| Buntlines, | 7 | | 40 |
| <i>Fore-Top-Mast.</i> | | | |
| Shrowds, | 4 | Inches | |
| Tackles, | 4 | | |
| Halyard, | 5 | | 7 |
| Stay, | 16 | | 14 |
| Lifts, | 5 | | 28 |
| Sheets, | 33 | | 24 |
| Clew-Line | 7 | | 38 |
| Buntlines, | 6 | | 37 |
| Braces, | 21 | Threads | 27 |
| Bowlines, | 21 | | 30 |

Rigging of the Top-Gallant of the Bow-sprit.

| | | |
|----------------------------------|----|-------|
| The Halyard must have in Length, | 3 | Fath. |
| The Lifts, | 8 | |
| The Braces, | 18 | |
| The Clew-Line, | 16 | |
| The Buntlines, | 18 | |
| The Sheet, | 18 | |

The Tackles of the Sprit-Sail.

| | | |
|--------------------------------------|----|-------|
| The Buntlines, | 18 | Fath. |
| The Braces, | 18 | |
| The Lifts of the Middle of the Yard, | 3 | |
| The Sheet, | 16 | |
| The Halyard, | 6 | |
| The Safeguard of the Bow-sprit, | 6 | |
| The Crane-Line, | 18 | |

Tackles of the Fore-Top Gallant.

| | | |
|----------------|----|-------|
| The Stay, | 18 | Fath. |
| The Braces, | 30 | |
| The Lifts, | 10 | |
| The Buntlines, | 22 | |
| The Bowlines, | 24 | |
| The Clew-Line, | 28 | |
| The Halyard, | 3 | |
| The Sheets, | 24 | |

The Tackles of the Fore-Top Mast.

| | | |
|-------------------------|----|-------|
| The Stay, | 15 | Fath. |
| The Runner and Tackles, | 8 | |
| The Lifts, | 28 | |
| The Halyard, | 7 | |
| The Braces, | 30 | |
| The Bowlines, | 30 | |
| The Buntlines, | 32 | |
| The Clew-Line, | 30 | |

Tackles of the Fore-Mast.

| | | |
|-------------------------|----|-------|
| The Stay, | 12 | Fath. |
| The Runner and Tackles, | 12 | |
| The Lifts, | 28 | |
| The Braces, | 20 | |
| The Buntlines, | 24 | |
| The Tacks, | 14 | |
| The Bowlines, | 15 | |
| The Sheets, | 36 | |
| The Halyard, | 14 | |
| The Clew-Line, | 35 | |
| The Lanniard, | 5 | |

Tackles of the Main-Top Gallant.

| | | |
|----------------|----|-------|
| The Stay, | 20 | Fath. |
| The Lifts, | 10 | |
| The Halyard, | 4 | |
| The Clew-Line, | 30 | |
| The Braces, | 32 | |
| The Buntlines, | 23 | |
| The Bowlines, | 30 | |

Tackles of the Main-Top Mast.

| | | |
|------------------|----|-------|
| The Stay, | 21 | Fath. |
| The Lifts, | 29 | |
| The Braces, | 30 | |
| The Buntlines, | 33 | |
| The Bowlines, | 34 | |
| The Halyard, | 8 | |
| The Clew-Line, | 34 | |
| The Stay Runner, | 18 | |

The Tackling of the Main-Mast.

| | | |
|--------------------|----|-------|
| The Stay, | 16 | Fath. |
| The Stay Runner, | 16 | |
| The Lifts, | 29 | |
| The Braces, | 30 | |
| The Sheets, | 30 | |
| The Tacks, | 16 | |
| The great Bowline, | 24 | |
| The Halyard, | 24 | |
| The Clew-Line, | 38 | |
| The Buntline, | 26 | |
| The Lanniard, | 6 | |

The Tackling of the Mizzen-Top Gallant.

| | | |
|-------------------|----|-------|
| The Running Stay, | 10 | Fath. |
| The Halyard, | 4 | |
| The Lifts, | 10 | |
| The Sheets, | 12 | |
| The Buntlines, | 15 | |
| The Bowlines, | 16 | |
| The Braces, | 11 | |

The Tackling of the Mizzen Mast.

| | | |
|----------------|----|-------|
| The Stay, | 10 | Fath. |
| The Halyard, | 8 | |
| The Clew-Line, | 28 | |
| The Sheet, | 16 | |
| The Buntlines, | 20 | |
| The Bowlines, | 18 | |
| The Lifts, | 5 | |

Note again, That here follows another Manner of cutting the Tackling, and of regulating their Proportions.

To this Effect, one must take a Line and make an oilet Hole at one End thereof, and turn it round the Top of the Mast, then bring the Line downwards, as far as the Chain Wall, to the Ram's-block, which is the first in order in coming towards the Stern; and take the Measure at its Iron Hoop, or at its Middle, according to the Length the Shrowds must have when they are stretched out, which is tried in this Manner: One cuts with a Hatchet a small End of the Shrowd, if it be of several Cords, and stretches it with Violence; then he carries the Line to it, takes Measure for all the Shrowds, from the first to the last; and each Time ties a Knot to the Line. When he has thus taken the Measure, he goes on Deck, where he thrusts a Splicing-Iron, from which drawing and measuring the Line, chalking every Knot: This done, he takes the Cordage, puts an End of it to the Splicing-Iron, and then cuts it at each Mark. Afterwards each Shrowd is placed separate from each other, round the Splicing-Iron. And in the same Order they are

Note, That here follows another Manner of Rigging a Ship of 123 Feet in Length, and 28 in Breadth.

are to be placed round the Cap of the Mast. Then the oiler Hole of the Line is measured on the Marks, and in cutting each Shrowd a Mark is made to it for the oiler Hole; and by that Means one has the Measures for all the oiler Holes. This done, each Shrowd is thrust under the oiler Hole, as far as the Place where they can touch one another. To *capelate* of the Lanniard must be placed first, then the Shrowds, and a-top the Pulley of the Lifts, then the Stay.

Another Manner of cutting the Shrowds.

The Height of the Mast must be taken with a Line from the Bars of the *Scuttle*, as far as to the Etambraie, and join to it one Twelfth of the Space which is between the Middle of the Etambraie, and the Girt; these two Measures being put together, will make the Length of the Shrowds. Adding to it afterwards the Thickness of the Ton of the Mast, and thrusting a Bodkin on the Deck, to measure in a strait Line the Length of the Rope taken on the three Measures joined together; cutting afterwards on that Measure, one over another, of an equal Length at Bottom.

Note, That the *Main-Stay*, and the *Stays* of the Fore and Mizen-Masts, are cut as follows.

To cut the great Stay, we must take a Line and make an End thereof run a-top, round the Bar of the Main-Scuttle; then take underneath the Measure of the Diameter of the Main-Mast, and let the other End come down as far as the great Etambraie, which is the just Measure for the Length, and for the oiler-Hole.

The *Stay* of the Fore-Mast is cut, by taking with a Line the Length of the *Scuttle-Bar*, and the whole Diameter of the Mast, bringing the Line afterwards as far as the Boltspirit, or the Collar of the Main-Mast.

To cut the *Shrouds* of the *Top-Mast*. The Length of the *Shrouds* of the Main-Top-Mast, is found by taking the Measure of the *Scuttle-Bar*, from the Mortise of the said Mast, and joining to it the Diameter of the Ton; following for the rest the Directions given for the *Main-Shrouds*, whereby one will have the Measure for the oiler-Hole, and to Belage. The same must be observed with regard to the two *Top-Gallants*, and those of Mizen and Boltspirit.

To cut the *Stay* of the *Main-Top-Mast*. One must take Measure from the Main Bar of the *Scuttle*, to the *Scuttle* of the Fore-Mast. For the *Stay* of the Fore-Top-Mast, the Measure must be taken from the Bar of the *Scuttle* of that Mast to the Deck, and join to it 3, 4, or 5 Fathoms, according to the Bigness of the Ship; and thus will be found the Length of the *Stay*, and what's necessary to fasten it.

To cut the *Tackles*. One takes the Measure of the Bar of the *Scuttle* down to the Bottom, round the Ram's Block of the *Lanniards*, i. e. of that which is more towards the Stern; and they are cut in the same Manner of the *Shrowds*.

To cut the *Clew Lines*, their Length is taken from the *Scuttle-Bar* down to the Deck; and that Length is doubled as many Times, as there are Spindle-Wheels, upon which the *Clew Line* runs.

To cut the *Halyards*; when they pass through Pulley, of Return, their Measure must be taken twice from the Cap of the Mast to the Deck, which gives justly their Length. But when they must pass through the *Cleoput*, they ought to have four Fathoms more. The *Halyards* of the *Top-Masts* are made of the Length of the Mast.

To cut the *Runners* and their *Tackles*, they must have as Length as many Fathoms as the Ship is broad; and their *Tackles*, for the Vessels which have 30 Feet of Midship, must be of 10 Fathoms. Those for Vessels of 25 Feet of Midship, must have 9 Fathoms; and those for Vessels which have 20 Feet of Midship, 8 Fathoms.

To cut the *Tackle* of the *Sprit-Sail*. The *Braces* must have twice and a half the Length of the Yard; and a Fathom of Lifting.

The *Crane Line* must have twice and a half the Length of the Yard.

The *Buntlines* 2½ the Length of the Yard, and a Fathom of Lifting.

The *Clew-Line* 1½ the Length of the Yard.
The *Sheets* 3 times the Length of the Yard.
The *Lifts* twice the Length of the Yard.
The *Halyard* ½ of the Length of the Yard.

The Tackling of the Top-Gallant of the Bore-sprit.

The *Stay* ½ of the Length of the Top-Gallant.
The *Clewline* ½ of the Length of the Top-Gallant.
The *Buntlines* 4½ of the Length of the Yard.
The *Lifts* 5 times the Length of the Yard.

The Tackling of the Fore-Top Mast.

The *Clewline* 5 times the Length of the Fore-Top Mast, and 2 Fathoms of Lifting.
The *Buntlines* 6 times the Length of the Yard, and 3 Fathoms of Lifting.
The *Bowline* 5 times the Length of the Yard.
The *Halyard* the Length of the Yard.
The *Lifts* 5 times the Length of the Yard, 2 Fathoms less.
The *Braces* 4½ the Length of the Yard.

The Tackling of the Fore-Mast.

The *Clewline* 4 times the Length of the Fore-Mast, 4 Fathoms of Lifting.
The *Halyards* 3 times the Length of the same Mast.
The *Runner* 4 times the Length of the Mast, 2 Fathoms less.
The *Buntlines* 2½ the Length of the Yard, and 3 Fathoms of Lifting.
The *Braces* twice the Length of the Yard, and 3 Fathoms of Lifting.
The *Bowlines* twice the Length of the Yard, 1 or 2 Fathoms less.
The *Tacks* twice the Length of the Yard, 1 or 2 Fathoms less.
The *Sheets* 3 times the Length of the Yard, 2 Fathoms less.

The Tackling of the Main-Top Mast.

The *Clewline* 5 times the Length of the Main-Top Mast, two Fathoms less for a single Pulley.
The *Lifts* 4 times the Length of the same Mast, 4 Fathoms less.
The *Tackles* 4 times the Length of the same Mast, 4 Fathoms less.
The *Halyards* once the Length of the same Mast.
The *Braces* 4 times the Length of the Yard of the Main-Top Mast, and 2 Fathoms lifting.
The *Bowlines* 3 times the Length of the Yard.
The *Buntlines* 5 times the Length of the Main-Top Mast, and 5 Fathoms lifting.

For the Main-Mast.

The *Clewline* 5 times the Length of the Mast, 2 Fathoms less.
The *Halyard* 3 times the Length of the Mast, 2 Fathoms less.
The *Runners* 3 times the Length of the Mast, and 7 Fathoms more.
The *Lifts* twice the Length of the Mast, and 2 Fathoms of Lifting.
The *Tacks* twice the Length of the Yard, and 1 Fathom of Lifting.
The *Bowlines* twice the Length of the Yard, and 1 Fathom of Lifting.
The *Braces* twice the Length of the Yard, and 1 Fathom of Lifting.
The *Sheets* 3 times the Length of the Yard.
The *Sheets* of the Main-Top Mast, twice the Length of the Yard.

For the Mizen-Mast and Mizen-Top Gallant.

The *Sheets* twice the Length of the Yard.
The *Clewline* 3½ the Length of the Yard.
The *Sheets* of the Top-Gallant, 2½ the Length of the Yard of
The *Clewlines* and *Buntlines* 4½ the Length of the Mizen-Top Gallant.
The *Lifts* 3½ the Length of the Top-Gallant Yard.
The *Bowlines* 4½ the Length of the Top Gallant Yard.
The *Braces* 6½ the Length of the Yard of the Top Gallant.

Note, That to cut the Cords which edge the Sails at Bottom, called *Rabans* in French, one must take three Times the Diameter of the Yard inside the Pulley, of the Sheets of the Top-Mast, and then cut each Cord on the Bottom of the Sail, at the Length of those three Diameters, adding that of an Inch Breadth to it.

Note also, That to fix the Bow-sprit, the Collar of the Stay must be passed into it, at one Third of its Length, taken from its upper End, and place the Clump of the Bolt-sprit half a Foot lower; and the Block of the Stay of the Top-Gallant at half the Length from the Clump to the upper End; and the *Ox-Eye* one Foot above the Collar of the Stay; and the Pulley of the Crane-Line five Foot lower than the Collar.

To divide a *Yard*, it must be first divided into two Parts, and the Pulley of the Halliard, or Clew-Line placed in the Middle; dividing it afterwards into three, fixing the Buntlines to it, and between two (at all the Yards) the Pulleys of the Buntlines.

The *Yard* of the Sprit-Sail ought to be divided in two, and the Halyard placed in the Middle. Then each half is again divided in two other Parts, placing in the Middle of each Part the Pulleys of the Cranelines: The Pulleys of the Buntlines are between these last and the Middle of the *Yard*.

The *Mizen-Yard*, is divided into as many Parts, as one desires to fix Pulleys to it.

To rig the *Bolt-sprit*, one begins by the Stay of the Top-Mast, then the *Trelingare*, which is fastened on the Stay of the *Main-Top-Mast*, the *Shroud*, and the Strops of the *Lifts*.

To rig the *Main-Top-Gallant*, and *Fore-Top-Gallant*, the *Shrouds* are placed first, then the Strops of the *Lifts*, and the *Stay*.

To rig the *Top-Masts*, the *Back Stays* are placed first; then the *Shrouds*, the Pulleys of the *Lifts*, the *Stays*; but the *Mogues* are fixed to the *Main-Top-Mast*.

To rig the *Fore-Mast*, one begins by the *Save Rabans*, then the Strap of the Stay of the Top-Mast, the Clew-Lines, the Straps of the *Lifts*, and lastly the *Stay*. The same is observed with regard to the *Main-Mast*.

To rig the *Mizen-Top-Gallant*, the *Stay* is placed first, which is terminated by the *Marticles* of the main *Shrouds*, then the *Shrouds*, and lastly the *Lifts*.

Note, again, That the Number of all the *Pulleys* wanted for a Ship, is 54 for the *Bolt-sprit*; 96 for the *Fore-Mast*; 116 for the *Main-Mast*; 44 for the *Mizen-Mast*: Besides which are wanted 166 Rams-Blocks.

Note, besides, that having thus far rigged our Ship, we'll pass to the finding out the Thickness and Weight of the biggest Ropes: Therefore,

The Thickness of the *Sheet-Anchor*, must be of as many Inches as there are Feet, in half the Breadth of the Ship. In Merchantmen, the *Common Anchor* is a little less in Thickness than the *Sheet-Anchor*.

To find how many Threads are wanted for the Thickness of a Cordage, one must know first how many Inches it has in Circumference, and number the Threads, and the Cube of the *Cordage* will contain the Number of its Threads. For Instance,

A *Cordage* of 5 Inches of Circumference contains 48 Threads; we will know the Number of the Threads of a *Cordage*, which is four Inches thick in Circumference.

| | | | | | |
|---------|----------|---------|-----|----|---------------|
| Inches. | Threads. | Inches. | 4 | (3 | } 85 Threads. |
| 3 | 48 | 4 | 768 | | |
| 3 | 16 | 4 | 99 | | |
| 9 | 768 | 16 | | | |

Therefore a *Cordage* of 4 Inches contains 85 Threads.

Note, That the *Threads* must be of an equal Bigness, and the *Cordage* equally tight; for a very tight Rope takes more *Threads*.

To find the Weight of *Cables* of 120 Fathoms, it has been found that every Thread of such a Cable weighs about 4 lb. Therefore the *Threads* must be multiplied by 4 whereby the Weight of such a Cable is found;

which is very clearly demonstrated in the following Table.

TABLE of the Thickness of the Threads, and of the Weight of Cables.

| Thickness. Inches. | Threads. | Weight. Pounds. | Thickness. Inches. | Threads. | Weight. Pounds. |
|-----------------------|----------|--------------------|-----------------------|----------|--------------------|
| 3 | 48 | 192 | 13 | 821 | 3284 |
| 4 | 77 | 308 | 14 | 952 | 3808 |
| 5 | 121 | 484 | 15 | 1093 | 4372 |
| 6 | 174 | 696 | 16 | 1244 | 4976 |
| 7 | 238 | 952 | 17 | 1404 | 5616 |
| 8 | 311 | 1244 | 18 | 1574 | 6296 |
| 9 | 393 | 1572 | 19 | 1754 | 7016 |
| 10 | 485 | 1940 | 20 | 1943 | 7772 |
| 11 | 598 | 2392 | 21 | 2144 | 8576 |
| 12 | 699 | 2796 | 22 | 2352 | 9408 |

In the first Column of this Table is seen the Thickness of the *Cables*; in the second Column the Number of Threads; and in the third, the Weight of the *Cables*.

Note, That the next Table is to find the Measure of the *Anchors*, and of the *Cables* by the Bigness of the Ships, to which they must serve.

| Bigness of the Ships by Feet. | Length of the Anchor by Feet. | Weight of the An- chor by Pounds. | Thickness of the Cables by Inches. |
|----------------------------------|----------------------------------|--------------------------------------|---------------------------------------|
| 8 | 3 $\frac{1}{2}$ | 33 | 4 |
| 9 | 3 $\frac{2}{5}$ | 47 | 4 $\frac{1}{2}$ |
| 10 | 4 | 64 | 5 |
| 11 | 4 $\frac{1}{5}$ | 84 | 5 $\frac{1}{2}$ |
| 12 | 4 $\frac{2}{5}$ | 110 | 6 |
| 13 | 5 $\frac{1}{5}$ | 140 | 6 $\frac{1}{2}$ |
| 14 | 6 | 175 | 7 |
| 15 | 6 $\frac{2}{5}$ | 216 | 7 $\frac{1}{2}$ |
| 16 | 6 $\frac{3}{5}$ | 262 | 8 |
| 17 | 7 $\frac{1}{5}$ | 314 | 8 $\frac{1}{2}$ |
| 18 | 7 $\frac{2}{5}$ | 373 | 9 |
| 19 | 8 | 439 | 9 $\frac{1}{2}$ |
| 20 | 8 $\frac{1}{5}$ | 512 | 10 |
| 21 | 8 $\frac{2}{5}$ | 592 | 10 $\frac{1}{2}$ |
| 22 | 9 $\frac{1}{5}$ | 681 | 11 |
| 23 | 9 $\frac{2}{5}$ | 779 | 11 $\frac{1}{2}$ |
| 24 | 10 | 884 | 12 |
| 25 | 10 $\frac{1}{5}$ | 1000 | 12 $\frac{1}{2}$ |
| 26 | 10 $\frac{2}{5}$ | 1124 | 13 |
| 27 | 11 $\frac{1}{5}$ | 1259 | 13 $\frac{1}{2}$ |
| 28 | 11 $\frac{2}{5}$ | 1405 | 14 |
| 29 | 12 | 1562 | 14 $\frac{1}{2}$ |
| 30 | 12 | 1662 | 15 |
| 31 | 12 $\frac{1}{5}$ | 728 | 15 $\frac{1}{2}$ |
| 32 | 12 $\frac{2}{5}$ | 996 | 16 |
| 33 | 13 $\frac{1}{5}$ | 297 | 16 $\frac{1}{2}$ |
| 34 | 13 $\frac{2}{5}$ | 2300 | 17 |
| 35 | 14 | 2515 | 17 $\frac{1}{2}$ |
| 36 | 14 $\frac{1}{5}$ | 2742 | 18 |
| 37 | 14 $\frac{2}{5}$ | 2986 | 18 $\frac{1}{2}$ |
| 38 | 15 $\frac{1}{5}$ | 3242 | 19 |
| 39 | 15 $\frac{2}{5}$ | 3512 | 19 $\frac{1}{2}$ |
| 40 | 15 $\frac{3}{5}$ | 3796 | 20 |
| 41 | 15 $\frac{4}{5}$ | 4096 | 20 $\frac{1}{2}$ |
| 42 | 16 | 4426 | 21 |
| 43 | 16 $\frac{1}{5}$ | 4742 | 21 $\frac{1}{2}$ |
| 44 | 17 $\frac{1}{5}$ | 5088 | 22 |
| 45 | 18 | 5451 | 22 $\frac{1}{2}$ |

Note, That having thus far fitted our Ship with its Cordage, Tackles, &c. we'll proceed to rig it with its different Sails, which are one of its principal Implements, since without them it would prove almost entirely useless.

A *SAIL*, is an Assemblage of several Breadths of Canvas, or strong hempen Cloth, sewed together by the Lifts, and edged round with a Cord, fastened to the Yards and Cords of a Vessel to make it drive before the Wind which bears thereupon.

The Measure of *Sails* is very unequal: Their Breadth, must be equal to the Lengths of the Vessels for which they are designed; the one must be more slack, and the other more tight: Which Dispositions depend on the Taste and Judgment of the Masters. But to give, at least in general, some Rules for their Measure, I say, that the Length of the Yards to which they are to be

fastened

fastened must be taken, joining that Length, which must make the Breadth of the upper Part of the *Sail*, with the Breadth of the lower Part; and half of both Breadths joined together, being multiplied with the Height, one finds thereby what the *Sail* must contain; provided the Length of the Yards be measured by the Breadth of the Canvas the *Sail* is to be made of.

There are two Kinds of *Sails*, the one square, generally used in high-bottom'd Vessels. This has various Names, according to the various Masts it is fastened to; as the *Main-Sail*, *Fore-Sail*, *Mizzen-Sail*, the *Sprit-Sail*, &c.

The others are triangular, called *Smack-Sails*, and by some *Latin-Sail*, because chiefly used in *Italy*, and in flat-bottom'd Vessels; though they are also used on the Mizzen-Masts and Stays of other Vessels. They need but few Ropes, and little Wind; but are dangerous, and not to be used in foul Weather.

There are ordinarily 10 *Sails* in large Vessels, viz. 1. The *Main-Sail*, or lowest of the Main-Mast. 2. The *Fore-Sail*, or lowest of the Fore-Mast. 3. The *Main-Top-Sail*, which is the second *Sail* of the Main-Mast, reckoning at the Bottom. 4. The *Fore-Top-Sail*. 5. The *Sprit-Sail*, or *Sail* of the Bow-sprit. 6. The *Top-Gallant* of the Bow-sprit. 7. The *Mizzen-Sail*. 8. The *Mizzen-Top-Sail*. 9. The *Main-Top-Gallant*. 10. The *Fore-Top-Gallant*. The *Stay-Sails*, the *Bonnets*, and the *Cape-Sails*, laced to the other *Sails* to sail faster.

The *Main-Sail* has in Breadth 23 Gatherings of *Dutch* Canvas, and 14 Yards in Height; and the *Net-marshed Bonnet* is $3\frac{1}{2}$ Yards long, and 23 Gatherings broad. The *Fore-Sail* has 20 Gatherings in Breadth, and $11\frac{1}{2}$ Yards in Height. The *Bonnet* 3 Yards. The *Main-Top-Sail* has 22 Gatherings downwards, and 14 Gatherings a-top, $15\frac{1}{2}$ Yards in Breadth, and 18 Yards in Height. The *Fore-Top-Sail* has downwards 19 Gatherings, and 12 a-top, and $14\frac{1}{2}$ Yards in Height. The *Sprit-Sail* has 14 Gatherings in Breadth, and $8\frac{1}{2}$ Yards in Height. The *Mizzen-Sail* has 16 Gatherings downwards, and 19 Yards of Height backwards: The *Bonnet* $1\frac{1}{2}$ Gathering, and 26 Yards at the Head. The *Net-marshed Bonnet* has $2\frac{1}{2}$ Yards in Height, and 16 Gatherings in Breadth a-top, and $17\frac{1}{2}$ Gatherings downwards. The *Sail* of the *Main-Stay* is 15 Yards long, and 13 Gatherings broad. The *Sail* of the *Mizzen-Stay*, has in Height $13\frac{1}{2}$ Yards, and 12 Gatherings in Breadth. And the *Sail* of the *Stay* of the *Mizzen-Top Gallant*, is likewise of the same Proportion with that above-mentioned. The *Sail* of the *Stay* of the *Main-Top Mast* has $10\frac{1}{2}$ Yards in Height, and 6 Gatherings at the Head. The *Sail* of the *Top-Gallant* of the Bow-sprit, has $14\frac{1}{2}$ Yards at Bottom, $9\frac{1}{2}$ at the Head, and 10 Yards in Height. The *Sail* of the *Mizzen-Top*, has at Bottom $13\frac{1}{2}$ Gatherings, 8 at the Head, and 9 Yards in Height. The *Sail* of the *Main-Top Gallant* has its upper Part equal to its lower. The *Sail* of the *Fore-Top Gallant*, has downwards 12, upwards 8, and in Height $7\frac{1}{2}$ Yards of *Dutch* Canvas; which makes in all 1626 Yards, 368 Yards of the second Cloth of *Noail*, and 146 Yards of *Flemish* Cloth.

For the *Measures* and *Proportions* of the *Anchors* and *Cables*, we must take with a Compass twice the Thickness of the Yard of the *Anchor* to find its Breadth; then we'll double the Inches which the Thickness gives, and give to the Length as many Feet, as there are Inches in that Thickness doubled, and an Inch besides above every Foot. For Instance, the Measure of the Thickness being 6 Inches by the Compass, that makes 12 Foot for the Yard, and by adding 13 Inches to it, the whole together make 13 Foot 1 Inch. Under 1000 Pounds, one must, *i. e.* for the Length of the Yard, add 2 Inches for each Foot, instead of 1, which has been marked above; and under 5000 Pounds take three Times the Thickness to give the Length. Thus when there are two Inches and a half of Thickness, the Length must be $7\frac{1}{2}$ Foot, half whereof, which is $3\frac{1}{4}$, 1 being taken for 100 Pounds, the Weight of the *Anchor* will be 3.

For the Thickness of the *Cables* in Proportion to the Weight of the *Anchors*. We must observe in the two following Tables, each whereof consists of 12 Articles, that each Article of the first must answer to the same Article in the second. For Instance, in taking in the first Article of the first Table, a Cable of 20 Inches, you'll

find in the second Table, at the first Article, the second Line, a common *Anchor* of 56 hundred and one fourth Weight; which is the Proportion of the *Anchor* for a Cable of 20 Inches, of the first Article of the first Table; and thus of all the rest.

First TABLE.

| 1. | Inch. | 2. | Inch. | 3. | Inch. |
|-----------|-----------------|-----------|-----------------|-----------|----------------|
| Cables of | 21 | Cables of | 20 | Cables of | 17 |
| of | 20 | of | 19 | of | 16 |
| of | $14\frac{1}{2}$ | of | 13 | of | 12 |
| of | 10 | of | 9 | of | 8 |
| of | 9 | of | 8 | | |
| 4. | | 5. | | 6. | |
| Cables of | 12 | Cables of | 15 | Cables of | 13 |
| of | 16 | of | 14 | of | 12 |
| of | 11 | of | 9 | 7. | |
| 8. | | 9. | | Cables of | 10 |
| Cables of | 16 | Cables of | 14 | of | 9 |
| of | 15 | of | 13 | 11. | |
| of | 10 | of | $12\frac{1}{2}$ | Cables of | 8 |
| 10. | | of | 12 | of | $7\frac{1}{2}$ |
| Cables of | 12 | of | 8 | of | 6 |
| of | 12 | 12. | | | |
| | | Cables of | 8 | | |
| | | of | 7 | | |
| | | of | 6 | | |

| 1. | 104 lb. | 7. | 104 lb. |
|--------------|---------|--------------|---------|
| Sheet Anchor | 60 0 3 | Sheet Anchor | 22 0 2 |
| Common Anch. | 56 0 1 | Common Anch. | 11 0 0 |
| Stream Anch. | 55 0 0 | | |
| Kedge Anch. | 25 0 0 | 8. | |
| Grapler | 7 0 2 | Sheet Anchor | 27 0 0 |
| 2. | | Common Anch. | 23 3 5 |
| Sheet Anchor | 43 0 0 | Stream Anch. | 23 0 0 |
| Common Anch. | 40 0 5 | | |
| Stream Anch. | 39 0 3 | 9. | |
| Grapler | 7 2 0 | Sheet Anchor | 18 0 0 |
| 3. | | Common Anch. | 17 0 0 |
| Sheet Anchor | 35 3 3 | Stream Anch. | 16 0 2 |
| Common Anch. | 34 0 2 | Kedger | 4 2 0 |
| Stream Anch. | 31 2 7 | Grapler | 2 2 0 |
| Kedger | 11 3 5 | | |
| 4. | | 10. | |
| Sheet Anchor | 32 0 0 | Sheet Anchor | 11 0 0 |
| Common Anch. | 30 2 2 | Common Anch. | 10 0 0 |
| Stream Anch. | 27 0 0 | | |
| 5. | | 11. | |
| Sheet Anchor | 29 0 0 | Sheet Anchor | 7 0 0 |
| Common Anch. | 25 0 0 | Common Anch. | 6 0 0 |
| Stream Anch. | 23 3 2 | Stream Anch. | 5 2 0 |
| Kedger | 9 0 0 | | |
| Grapler | 2 2 7 | 12. | |
| 6. | | Sheet Anchor | 5 0 2 |
| Sheet Anchor | 28 0 0 | Common Anch. | 4 0 0 |
| Common Anch. | 27 0 0 | Stream Anch. | 3 2 3 |

The *Sheet-Anchor* is used in a Storm; the *Stream-Anchor* daily; and the *Kedger* to tow a Ship.

Note, That though the *English* follow in the Construction of their Ships or Men of War, the Method of other Nations; or rather the other maritime Nations follow at present that of the *English*; I'll give, notwithstanding, in the following Table, the Proportion which they observe in the Parts named in the following Table.

| | Length. | Diam. |
|------------------------------------|---------|-------|
| | Feet. | |
| The Yard of the Bow-sprit Top Mast | 18 | 5 |
| of the Fore Top Gallant | 18 | 5 |
| of the Main Top Gallant | 23 | 8 |
| of the Mizzen Top Mast | 24 | 8 |
| The Mast of the Main Top Gallant | 28 | 10 |
| The Mizzen Top Mast | 34 | 10 |
| The Yard of the Fore Top Mast | 39 | 12 |
| of the Main Top Mast | 46 | 14 |
| of the Mizzen Top Mast | 42 | 12 |
| The Mizzen Yard and Sail | 73 | 11 |
| The Fore Top Mast | 47 | 17 |
| The Main Mast | 55 | 18 |
| The Mizzen Mast | 60 | 22 |

| | Length | Diam. |
|------------------------|--------|------------------|
| | Feet. | |
| The <i>Mizzen Yard</i> | 79 | 25 $\frac{1}{2}$ |
| The <i>Bowprit</i> | 85 | 28 |
| The <i>Main Yard</i> | 93 | 30 |
| The <i>Mizzen Mast</i> | 95 | 31 $\frac{1}{2}$ |
| The <i>Main Mast</i> | 107 | 36 |

The *English* commonly give of Length to their Main-Mast, three times the four Fifths of the Length of their Ship. All the rest is made likewise in Proportion as the Ship has more or less Length or Breadth; for it is the greater or lesser Breadth of the Vessel, which contributes towards its having a greater or less Volume of Masts and Sails, and to make it take more or less Wind.

The *English* Ships have large and magnificent Galleries, the *Dutch* have but small ones.

Note, That here follows a more exact Description of all the Parts of a Man of War of 155 Foot in Length.

This Length is taken from the Main Stem to the Stern Post. The Ship has 36 Feet of Midship, and 12 Feet of Bottom or Depth at the first Deck, 17 at the second Deck, and 24 at the third Deck, and 3 Feet 6 Inches of Viboard.

The *Keel* is of three Pieces, and the Sides thereof are 10 Feet long, and 4 Inches thick at their Ends: Each of them being joined by 25 Peggs, to each whereof is given an Inch of Diameter, for every hundred Feet the Ship has in Length.

The *Main Stem* measured outside on its Roundness, is 37 Feet 2 Inches long, and at the Square, in the Angle inside, 27 Feet 9 Inches. It has 7 Feet of Curve Line; of Thickness outside, 15 Inches; inside 1 Foot 3 Inches; of Breadth downwards, 3 Feet 9 Inches; by the Middle, 28 Inches; a top 3 Feet 5 Inches.

The *Stern Post* has 22 Feet 3 Inches at the Square; of Thickness inside, 1 Foot 6 Inches; outside a top, 1 Foot 1 Inch, and at Bottom 10 Inches. Its Back is of 7 Feet; it has of Binding inside, 1 Foot 2 Inches.

The *Tillard Transom* is 25 Feet 6 Inches long backwards, and 2 broad; 1 Foot 7 Inches thick in its Middle, and at its Ends 1 Foot 5 Inches.

The *Shores*, or *Supporters*, measured from their lower End outside, from the *Tillard Transom* to their upper End, have 14 Feet 9 Inches; 1 Foot 1 Inch of Thickness, 2 Feet 3 Inches in Breadth in their Middle, and 2 Feet at their End; and 3 Feet in Roundness backward.

The *Counter Transoms* have in Thickness, on the *Stern Post*, 1 Foot 1 Inch, and from the Top downwards 1 Foot 2 Inches; the Uppermost is placed at 2 Feet 2 Inches, under the *Tillard Transom*; the Port Holes are at 2 Feet Distance from the Stern Post, and are 2 Feet 4 Inches broad; the Futtocks of the *Tillar* are 8 Inches thick, and the Pieces of Timber put to lengthen the Poop ascend to 27 Feet 6 Inches above the *Tillar's Transom*, and are at 3 Feet 3 Inches Distance from each other a top.

Of the two great *Gabarits*, the first coming from the Prow towards the Poop, is placed at 36 Feet Distance from the *Ecart* of the Main Stem; and the Flowers have 3 Feet 2 Inches at the Square: At half a Foot from the Platform there are 30 Feet in Breadth; and at the Height of 17 Feet, there are likewise 36 Feet in Breadth. The other grand *Gabarit*, is 10 Feet distant from this, towards the Stern; and between both there are six Floor Timbers, each whereof has 9 Inches in Breadth, and are placed at 7 Feet Distance from each other.

The fore Part of the first *Gabarit* forward, is 8 Inches distant from the last *Ecart* of the *Main Stem*; and has 28 Foot in Length.

The last *Gabarit* backwards, is placed at 18 Feet 6 Inches from the Heel of the *Keel*; and is 386 Inches in Length.

The *Ribs* are on the *Keel* 1 Foot thick; in the Floors 10 $\frac{1}{2}$ Inches; on the Line of the strongest Part, 8 Inches; on the *Transoms* of the *Viboard*, 5 Inches; those of the fore and back Parts are a little thinner.

Each Side of the Ship has been formed on 15 *Transoms* of *Gabarit*, viz. 11 under the Line of the biggest Part, and 4 under it, and one besides for each *Herpe*.

The *Carline* is 1 Foot thick, and 2 Feet 5 Inches

long; but is a little thinner and narrower forwards than backwards.

The *Beams* of the first Deck are 1 Foot 3 Inches thick; and 1 Foot broad, a little more or a little less, according as the Wood requires it: They are placed at the great Hatch, at 7 Feet Distance from each other; at 9 Feet above the Bread-Room; and most of the others are 4 Feet 6 Inches distant from one another.

Those of the *second Deck*, are a little stronger, and placed directly above those of the lower Deck, at the Height of 5 Feet in the Middle of the Ship, and of 4 Feet 6 Inches forwards. Those over the Bread Room are placed once nearer each other than those of the lower Deck.

The *Beams* of the upper Deck are 1 Foot 1 Inch broad, some of them a little more, the others less, 10 Inches thick, and 28 Feet long, most of them being 4 Feet 6 Inches distant from one another. The Floor-Timbers of the Fore-Castle, are 8 Inches thick, and 10 long.

The *Floor-Timbers* of the Half-Deck, and of the Captain's Room, are 9 Inches thick, and 1 Foot broad. To measure from over the Deck, and near the Main-Mast: They are placed at the Height of 7 Feet; and at the Height of 7 Feet 6 Inches backwards.

Forwards, where the Bread Room begins, there is a *Cross* to hinder the Fashions from sinking Inside; the Pieces of the Cross are 10 Inches thick length-wise, and 1 Foot 2 Inches cross wise.

The great *Capston*, at that Part which passes on the second Deck, there are 7 Spindles, and only 6 under Deck: Its Thickness at the Head is of 2 Feet 5 Inches at the *Carline* of 1 Foot 7 Inches, on the Dish of 1 Foot 5 Inches; at the Head it is 5 Feet 5 Inches high.

The Head of the little *Capston*, is 1 Foot 6 Inches thick, and 4 Foot 4 Inches high; it has 5 Spindles round it, and turns on a Dish fixed on the Floor-Timbers.

The Heads of the *Pillars* of the *Bits* are 5 Feet 4 Inches high, and 1 Foot 9 Inches thick length-wise of the Ship, and 1 Foot 8 Inches cross-wise. The Bolster is 9 Feet 3 Inches long, and 1 Foot 8 Inches thick square-wise: The Heads are 2 Feet high above the Bolster, which at each End extends two Feet beyond the Pillars, and are lined backwards, with a wash-Board, to preserve the Cable.

The Diameter of the *Hawse-Holes*, is 1 Foot 4 Inches; they are bored at 2 Feet Distance from the *Main Stem*, and at 8 Inches from one another.

The Length of the Captain's Room, taken from the Pieces of Timber which lengthen the Poop inside, is 21 Feet, as well as the Quarter-Deck; and the Length of the Fore Castle is 33 Feet.

The *Cook Room*, which is Starboard, is 9 Feet 6 Inches long, and 4 Feet 2 Inches broad. The hind Part of the Chimney is 4 Feet 5 Inches distant from the Partition of the back Part of the Kitchen; the Iron Bar behind is 21 Feet distant from the Mason Work, and that forward 7 Inches, and 1 Foot above the Pavement: The Funnel for Smoak, is 24 Inches broad, lengthwise of the Vessel, and 31 Inches cross-wise.

The *Pit* for the Cables, which is on the second Deck, is of 26 Feet 6 Inches, measuring from the Stem inside.

The *Gun Room* is 27 Feet long, to measure from the *Tillar Transom*.

The *Powder-Room* is 6 Feet high, taking it near the *Carline*.

The *Arch-Pump* has 3 Feet 3 Inches of Diameter, on each Side there is a Bread Room, and a third directly behind. All these Works are made of very dry Boards, and double over one another. Two of the Bread Rooms are lined with Tin.

The *Port-Holes* of the second Deck are bored at 23 Inches under the Binding of the Scupper-Holes, and are from 27 to 28 Inches broad, length-wise of the Ship; those backwards are at 8 Feet 4 Inches Distance from the Shores inside. Most of the others are at about 8 Feet Distance from one another; except those between which is the Kitchen, which are about 4 Feet 6 Inches distant from one another.

There are 3 *Port-Holes* on each Side the Fore-Castle, and

and 2 in the Quarter-Deck ; which have in Breadth, length-wise of the Ship, 2 Feet 12 Inches.

The *Main Mast* on the second Deck, is on that Side towards the fore Part of the Ship, a Foot more backward than half the Length of the Ship, measuring from the *Stem* to the *Stern Post*. The *Fore Mast* is placed by the Center of its Diameter, at 12 Feet 7 Inches from the *Stem*, taken inside. The Middle of the *Carline* of the *Mizzen Mast*, taken on the upper Deck, is at the Distance of 20 Feet 6 Inches from the *Allonges* of the *Poop*, inside.

The *Pumps* are at 34 Feet from the *Stern-Post*, in the lower Part of the *Fashions* aft. They are risen, likewise, 34 Inches above the third Deck. The *Galleys* are risen 21 Inches above the *Pumps*, and have 14 Inches of jutting out forward.

There is under the *Port Holes*, between Decks, but one Girt, and another Piece which extends inside from the Lining. This Girt is 14 Inches broad, and 8 thick. The Base of the *Port-Holes* is 42 Inches broad by the Middle of the Ship, but fore and aft is a little narrower ; and is 4 Inches thick. The Base under the Transom of the *Viboard*, is 20 Inches broad, and 3 thick. The *Viboard-Transom* is 10 Inches broad, and 6 thick.

The first Side-Plank, above the *Viboard-Transom*, and which joins it backwards, is 14 Inches broad, and 2 thick.

The *Rudder* is 52 Inches broad, downwards, and 26 at the *Fauniere* ; upwards it is 19 Inches thick outside, and 16 inside. The *Helm*, from the Top downwards, 12 Inches, and 11 cross-wise.

The *Bolster* of the *Helm* is placed 21 Feet distant from the *Bulk-Head*, measuring from over the Tillard Transom : It has 9 Inches square-wise, and in its Length 18 Feet, which is between the Peggs, and supports the *Helm* in its Motion, it is arched of 4 Inches.

The *Whip-Staff* is 12 Feet 3 Inches long, exclusive of the Ring.

The *Main Bittacle* is 6 Feet 6 Inches long, 5 Feet broad, and 16 Inches in the Intervals, it being divided into five. The little *Bittacle* is 3 Feet 6 Inches long, 3 Feet 4 Inches in Height, and 13 Inches in the Spaces ; it is likewise divided into three Partitions or Windows.

The *Architrave*, which is over the Tillard Transom, is 18 Inches broad in its Middle, 16 Inches at each End, and 5 Inches thick. It juts out 5 Feet 6 Inches behind the *Allonges* of the *Poop*, and is, by its Middle, 10 Inches above the Side Planks of the upper Deck, which terminate to it : It is supported by 14 upright Beams reverse-wise, which are 8 Inches broad, and 6 thick. The two of the Middle, between which the *Helm* passes when it plays, are 32 Inches distant from one another. There is a good Plank of Oak on the *Bulk Head*, and is lined with Planks two Inches thick.

The *Freeze* which is over the *Architrave* is 3 Inches and a half thick, and juts out 4 Inches a top, being nailed at Bottom to the *Architrave* ; it passes likewise, by 11 Inches on the Sides beyond the Side Planks ; on which Sides the Foot of the Gallery is joined.

The *Simatium*, which is over the Windows of the Gallery, is inside, at 7 Feet of the hind Part of the Boards which lengthen the *Poop* ; and to measure from the Top of the *Freeze*, which is over the *Architrave*, slanting, as far as the Top of the *Simatium* ; this is found placed 6 Feet 4 Inches above the other, having for its Middle 15 Inches in Breadth, and 18 at its Ends, and as much arching as the *Architrave* underneath : Its Thickness, which is 4 Inches and a half, re-enters inwards, of an Inch and a half round the Posts of the Gallery. The other *Freeze*, which is 2 Inches thick, is a-top, and in its Middle 36 Inches above the lower *Freeze*, and the Transom a top juts backward 12 Inches beyond the Planks.

The *Leat* or *Support* of the Gallery is 10 Feet long ; it has inside 7 Buttocks, 6 Inches broad, and 5 thick ; and as many under the Covert. It juts out 36 Inches beyond the Pieces of Timber which lengthen the *Poop*, towards the Body of the Ship. The *Pediment* of the Gallery is placed 39 Inches forward, on the back Side of the *Allonges* ; the Plank which is placed upright, and adorn'd with Relievo's on the Side of the Gallery, is 18 Inches broad backwards, and 13 forwards.

The *Posts* with their Figures and Ornaments are 12 Feet broad, and as much Thickness as the Relievo's will allow it.

Note, That here follows some very useful Maxims for the Construction of Vessels that they may sail well.

The *Main Stem* is a principal Piece on which most of the other most principal Members of a Ship are proportion'd ; a Method which Experience has discover'd far the best of all ; and in fact it is the most commonly followed, tho' some other Members may be equally taken for Foundation, in which the Ship-builder can very well succeed, if he adds to it the Proportions. The *Stem* must be made round outside, to break the Strength of the Sea. The modern Method is to put towards the Bottom of the *Stem*, inside, beginning at its *Esart*, and then going upwards, strong Pieces, *Guerlands* and others, which are joined together with the *Stem* and other Members in the Cheeks, which strengthen much the Cutwater, and all the Head.

There are no Rules to be prescribed for the Fashion, and Proportions of the Cutwater ; that depends almost entirely on the Experience, Taste, and Genius of the Undertakers. Notwithstanding which it is certain, that the *Volute* under the Lion, ought never to exceed the Height of the *Yard-Bearers* at the Fore-Castle, when there is one. Formerly the Cutwaters were very long ; at present they are made short, light, and much arched ; rising up almost in a strait Line, which does not seem very commodious, especially in large Vessels, because one cannot find the Space requir'd for the Uses to which that Part seems to be design'd.

It is true, that when a Ship is built only to sail on some short Expeditions, either in War, or otherwise, and not to carry large and heavy Ladings, it is proper to make the Cutwater pretty short, and the Bowsprit likewise, because the longer the Cutwater, the more the Trace it makes gives Strength to the Waves, to shake and make the Vessel roll, especially in hard Weather, which retards its Sailing.

The Cutwater is sometimes exposed to Accidents, which not only render it useless, but even hurtful, if it be long and loaded with Wood ; and then one is obliged to cut it at Sea : Besides which it often makes the Ship fall on its Nose. A Man of War should have a Cutwater at least of a middle Bigness, because of the Advantages Sailors reap from it, as well to wash their Persons and Cloaths, and for their natural Necessities, as for the Working of the Bowsprit. It serves as a Prison for those who are put in Irons ; besides which the Cutwater is a great Ornament to a Ship.

When the *Keel* lowers more than the rest of the Ship, it makes a deeper Trace, which hinders the Ship from lying by. Some make it a little rising in its Middle, because there lies the heavier Part of the Lading, which makes that Middle to go down by Degrees, which then becomes even with the rest of the *Keel*, and renders it strait : On the contrary, it happens very often, that when the *Keel* is made strait, it bends afterwards outside, whence proceeds several Inconveniencies.

The End of the Heel of the *Keel* which juts out, is a Support for the *Rudder*.

The *Rudder* is not made to go down lower than the *Keel*, for fear it should touch. It must not be too large, lest it should render the Working of the Ship too difficult, and more easy to be carried off by the Tempest ; neither is it to be made too narrow, because the Ship would not feel it enough ; nor ascend too high, because of the *Buttock's Bar*, which by pressing too hard upon it would obstruct its Motion ; but on the other Side, it must not be kept too low, because if the *Helm* was to descend lower than the *Bulk Head* of the Gun Room, it would embarrass that Room, and render it almost impracticable ; so that much Regard ought to be had to proportion well its Height.

Note, That to speak in few Words of the Effect of the *Rudder*, and explain how a Ship which is so heavy a Mass, changes Place by the Motion of a small *Rudder*, we must consider, that to put a Ship on a Point of the Compass, the *Rudder* must be made to turn towards that Point. Therefore when it is made to

turn towards the Side where the Cap is to be carried, the Sea which rolls and strikes against the Rudder, while the Helm plays and makes it turn, makes necessarily the Ship turn, till both the Ship and the Rudder be on the same Line; and because the Rudder making a little Circle backwards, is the Cause that the Ship makes a great one forwards, it wants but a little Motion to make the whole Ship change Place. Whence it follows, that the longer the Ship is, the smaller must be the Motion which the Rudder gives it. It is for this Reason, that the Steers Man is always in Action, seldom stops, and has always his Hand at the Whip-Staff, because the Currents and Winds are always moving and changing. It would be easier to steer a Ship if it should sail in Seas where there is no Current, and was only moved by the Wind. The Currents are never favourable to the Rudder, but when in a strait Line with them, or at least thereabout; the Agitation on the Currents which take side-wise, being of no Use. What hinders a Ship from feeling its Rudder, is, when the Currents which take it side-wise, are stronger than the Motion which the Make of the Ship gives to the Water; and when the Rudder is too narrow, and not pressed by a sufficient Quantity of Water to make it move. The same Thing happens in a Calm, and when there are no Currents; and in general when the Rudder is not well proportioned to the Bigness and Construction of the Ship, or when it does not sink enough backward, as it is necessary for the Rudder to receive the Impression of a sufficient Quantity of Water. The same happens when the Stern of the Ship is too large, and hinders the Sea from striking as it should against the Rudder. It is certain, that the greater is the Angle which the Motion of the Rudder makes with the Keel, the slower is the Sailing of the Ship; for it is a Sign either of a Calm, or of a contrary Wind, and that the Sea which is very small, strikes but little against the Rudder; on the contrary, the quicker a Ship sails, the better it obeys its Rudder.

It is very proper that a Man of War should be broad upwards, to move the Cannon with greater Facility, and to contain a greater Number of Men for its Defence. The Ships of Burden must have a deep and big Hold, to contain a greater Quantity of Merchandize, and narrow a-top, that it may want but few Men to work it.

A Ship built both for War and Trade, must be of a middle Capacity and Bigness, viz. 134 Feet long from the Stem to the Stern-Post.

The best, stronger, and broader Pieces of Timber, are employ'd for the Construction of large Ships. Long and narrow Vessels sail better than large and short ones of the same Burden, because they float more, having a greater Extent of their Body, flat on the Water. The Construction of a Ship, the fore Part whereof is large a-top, and acute at Bottom, is thought the finest, and those Ships are supposed to sail better; because the Breadth a-top, giving it a greater Support on the Water, gives also to the lower Part which is sharp, a greater Facility to cut the Sea: Though when they are acute, they cannot so easily tack about, and come to the Wind.

The Vessels which are too strong of Wood a-top, and slight at Bottom, do not sail well; in that Case it is proper to keep the Cannons in the Hold till they be wanted. Those which sail backward do not sail well neither; whether the Fault proceeds from the Construction, or from a bad Stowage; the same must be said of those which lean too much forwards. When this Fault proceeds from their Construction, the Fore-Mast is to be made to lean backwards, to ease the fore Part of the Ship.

It is certain, that, in general, Ships of a middle Bigness and Capacity, are better at Sea than very large ones; because the Weight of these retards their Course, and that they often chance to touch on *Shallows* and *Shelves*, whence they are not got off easily. On the other Side, small Vessels are but of little Use for their Burthen.

Ships are made broader before than behind; if they were broader behind they would less feel their Rudder. The greater Breadth of Ships must be found at one

Third of their Length, taken from the Fore to the hind Part; for if their greater Breadth was more forwards, a Ship could not cut the Sea with the same Facility; and if more backwards, it would drive away the Motion of the Sea too far; which being weakened thereby, with regard to the Rudder, would hinder it from being felt.

The Captain's Room is situated backwards, because the Motion of the Ship is less felt there, and because also he can from that Place see all over the Ship.

The upper Deck leans sometimes by one Foot, on the Gun-Room, that the Cannon may be levelled with more Facility. In Merchant-Ships the Deck is sometimes half a Foot lower near the Main-Mast.

In Men of War, the *Side-Planks* between Decks must be level with the Water; wherefore there wants but little Height between Decks; which notwithstanding, as well in Men of War, as in others where there are two Decks at least, the Space between both must be of a Man's Height.

If the great Width a-top of Men of War is advantageous for fighting, because of the Quantity of Men it contains, those which are narrower have in their Turn the Advantage of being not easily boarded, because their large and round Belly drives away the Enemy, and renders the throwing the Grapler more difficult; but especially because the Enemy cannot so easily jump into such a Ship.

Ships are not to be risen too much, too much Height renders them light, and they take too much Wind. On the other Side, when they are too low the Waves cover them with Water continually. Care must be taken likewise, that the Boards should not be too much arched, because then they break and split easily. The Boards are ill bent, when in heating them they are too much pressed at Bottom.

Ships which are too long are weak of Construction in all their Members; they commonly work and split, especially when they touch. Those which are too short don't sail well, and roll extremely. Those which have too much Mast are easily overturned.

The *Keelson* is made larger than the *Keel*, because of the Hole made in it for the Foot of the Main-Mast: It is joined and well fastened to the *Keel* with Iron Pegs, and contribute much towards strengthening the Ship.

Ships are calked and done over with Pitch and Tar, as well to preserve them and make them last, as to hinder the Water from running through the Cracks and Seams; this Operation is made by means of Tow, which, after it has been boiled and dried, either in the Sun or in an Oven, is spun very loose as big as the Arm, and thrust afterwards by the Calker into the Seams of the Ship. Some use for the same Purpose Moss, or the Hairs of Beasts; but Moss is best for the Cracks, and Tow for the Seams: When the Seams and Cracks are lined with it, they must be done over with Tallow, Pitch, and Tar.

The *Graving* a Ship is to be done over with, from underneath to the Line of Water, is a Composition made of Rosin, Tallow, Brimstone, Train-Oil, and pounded Glas, to preserve them from Worms. When a Ship is to make a long Voyage it is sheathed, and the Boards thereof are garnished with an almost infinite Number of small Nails.

The Ribs and Members placed to the *Gabarits*, between which the main Hatch is situated, must be very strong of Wood, because the Aperture weakens that Part, where there are neither *Beams* nor *Futtocks* to traverse the Ship.

The *Viboard* is higher on the fore Part, than in the Middle of the Ship, to shelter it against the Rage of the Sea. The Bars of the Scuttle of the Top-Gallants serve to keep the Looses of the Flag, therefore there is but one Hole. At the *Cutwater*, under the *Bulk-Head*, there is a *Cat-Head* to support it, when the Anchor is worked.

At each *Shroud* is an Iron Chain very even, and all of a Piece, which traverses it; to which a Rope is tied, which runs on four spindle Wheels, by means whereof the Shrouds are made tighter, to keep the Masts firm on each Side. There is another *Cadena* or Chain, which is moveable and serves to pass a Crane into it, to lift up on board heavy Burthens, and put the *Shallop* to Sea.

The

The *Puttock-Shrouds* are made tighter by Means of *Ram's Blocks*.

When all the Cracks and Seams have been well calked, all the dead Work is done over with Pitch and Tar (this Term of dead Work being taken in its wide Sense for all that is out of the Water) for the Pitch does not stick to what is in the Water.

Note, That after this Explication of the different Pieces, or Members a Ship is composed of, of their different Uses, we'll put a Ship on the Stocks, and shew what Order is observed in the Disposition of those different Pieces, and how they are joined together, giving, at the same Time, a clear Explication of the different Terms they are expressed by: Therefore,

1. MODEL, or Gabarit.

When a Ship-builder makes the *Draught* or *Model* of the Construction of a Ship, he gives the Name of first *Model* or *chief Rib*, to that *Rib* which is to be placed under the main Beam, and which answers to it; and even to the whole *Model* raised perpendicularly over it.

The second, third, and fourth *Model*, fore or aft, are the other *Models* raised on the other Beams, fore or aft. Those *Models* are made with Pieces of thin Boards, to represent the Length, Breadth, and Caliber of the Members, and Parts of a Ship, when to be built and put on the Stocks.

Explication of the first Model.

FIGURE I.

1. *Ribs* of the first Deck, which must have two Thirds of the main Stem.

2. *Futtocks* of the upper Deck; they must have the same Thickness with the *Ribs* of the first Deck.

3. The *Scupper Holes Bindings*, of the lower Deck, are Pieces of Wood which running round the Ship inside, serve to join it, and must be 19 Inches broad, and 5 or 6 Inches thick; those of the upper Deck 17 Inches broad, and $3\frac{1}{2}$ to 4 Inches thick. Which is the Decision of Master Ship-builders who have regulated the Proportions of a Ship of 137 Feet in length.

4. *Scupper-Holes*, they are Apertures made shelving, in the Length of a Piece of Wood, placed on the Side of the Ship, for the running out of Rain and Sea-Water. The *Scupper-Holes* of the upper Deck, *i. e.* the Pieces of Wood where the Holes are made, must be 4 Inches broad, and 4 thick; and the Holes have 2 Inches Diameter, if the Aperture be round, but it is most commonly made square-wise, and of several Pieces. The *Scupper-Holes* of the lower Deck must be 6 Inches broad, and $5\frac{1}{2}$ Inches thick; and the Holes have 3 Inches Diameter.

5. The *Burdens of the Deck*, which must be 17 Inches broad, and $4\frac{1}{2}$ thick: We'll have Occasion afterwards to regulate better their Proportions.

6. The *Side-Planks*, which serve to cover the first Gun-Deck, are $2\frac{1}{2}$ Inches thick.

7. The *Belier* of the Carriage.

8. The *Floor-Timber* of the lower Deck, which is a Girder placed with several others, throughout the Breadth of a Ship, and rests on two *Ribs*, by its two Ends. Most Carpenters give them $1\frac{1}{2}$ Inch for every 10 Feet of the Length of the Ship, taken from the Stem to the Stern-Post; every 10 Feet in Length given them, likewise an Inch of Roundness arch-wise.

9. The *Wheel* of the Carriage.

10. The *Allonge* of the *Migrinier*, which is the first, or that joined with the *Rib* and *Knee* of the Bottom.

11. The *Knee of the Bottom*, which is joined with the first *Allonges* and *Ribs*, they must have in their Angle half the Thickness of the Stem.

2. MODEL, or Gabarit.

FIGURE II.

1. The *Keel*.

2. The *Platform*, which begins at Number 2, and ends at 2.

3. The *Floor-Timber*, which crosses over the *Keel*, and over all the Bottom.

4. The *Lengthening* or *Allonge*, which forms the Breadth and Depth of the Ship.

5. The *Serre-Bauquierre*, in which the *Beams* are joined, in the Shape of a Swallow's Tail. The *Serre-Bauquierres* run all round the Ship. They have sometimes half the Thickness of the Stem, taken inside; others give them two Fifths of that same Thickness.

6. The *Vaigre* above the *Scupper-Holes binding*.

7. The *Rib* of the first Deck.

8. The *lowermost Deck* between the *Flowers* and the lower Precinct.

9. The *Flowers*: For the Beauty of a *Model*, the *Flowers* must ascend and rise with a Roundness agreeable to the Sight, and well-proportion'd. The *Flowers* are formed by the Junction of the *Floor-Timbers* with the *Knees* of the Bottom.

10. The *Side Planks* between the *Girts*.

11. The *Girts* with their jutting out.

12. The *Transom* of the *Viboard*, which makes the last and higher *Girt* of the Ship, and which is most like the other *Girts*.

13. *Beams* of the upper Deck.

14. A *Strop* commonly placed on the Binding, as the *Allonges* are under it, to strengthen the Ship which carry much Cannon.

15. The *Vaigres* of *Empature* of the *Knees* and *Floor-Timbers*.

16. The *Vaigres* of the Bottom, and placed under the first *Girts*.

17. The *Carline*, which is the biggest Piece of Wood employed in the Hold of a Ship; several of them are put End to End, and placed on all the *Ribs*, and as they serve to tie them with the *Keel*, they are often called *Keelson*, or *false Keel*.

18. The *Carriage* of a Ship Gun.

19. *Planks* which serve to cover certain Notches made in the *Floor-Timbers*, of which the Bottom of the Ship is composed; and those Notches serve for the Evacuation of the Water, which is in the Ship from the Prow to the Pumps.

20. The *Jarlot* of the *Keel*, where the *Gabord* enters; it is a Kind of Notch made in the *Keel*, in the Stem, and in the Stern-Post of the Ship, to introduce into it a small Part of the *Side-Planks*, which cover the Members of the Ship.

21. The *Line*, which hanging to the Level of the biggest Part of the Ship, is found a Foot distant from the lowermost Deck, at the Place where it ends, and where the *Flowers* begin in descending, and that's the Breadth of the biggest Part of the Ship.

FIGURE III.

Which represents in another Manner the same Pieces of the two preceding MODELS, and shew better the Roundness thereof.

1. The *Futtocks* under the *false Beams*, placed at every 6 Feet Distance, under the first Deck, to strengthen the Bottom of the Ship. These *false Beams* are Pieces of Wood, semblable to those over which often a false Deck is made; and where it has its greater Height, a Retrenchment is contrived, where the Soldiers retire to repose themselves and sleep.

2. The *Bindings* of the *Scupper-Holes*.

3. The *Weight* or *Burden* of the Deck.

4. The *Carline*.

5. The *Futtocks* of the upper Deck.

6. The *reverse Lengthenings*.

7. The *Binding* of the *Bauquiere*.

8. A *Scaffold* on which the Workmen place themselves.

9. The main Stem inside.

FIGURE IV.

Which shews distinctly and successively the Parts or Members of a Ship, which give it the Length and Depth it must have forwards.

1. The *Carline*.

2. The *Keel*.

3. The *Gabords*, or first Boards downwards, which form the outward Sides of a Ship. The Row of Boards which are placed above the *Gabord* are called *Ribord*.

4. The *Vaigres* and *Lengthenings*.

5. The *lowermost Deck*.

6. The *Floor Timbers*.

7. The

7. The *Knees* of the Bottom.
8. The *Ribs* which support the Deck.
9. The *Beams* of the first Deck.
10. The *Girts* with their jutting out.
11. The *Bindings* of the *Bauquiers*.

FIGURE V.

Represents,

1. The *Floor* or *Cieling*.
2. The *Weight* of the Deck, which is thick and narrow Boards notched, to put over the Beams in the Length of the Ships, on each Side, from fore to aft, at very near one Third of the Length of the Ship.
3. The *Flat Ribs*.
4. The *Lengthenings*.
5. The *Futtocks*.
6. The *Port Holes*, placed bandwise on both Sides of the Ship.
7. The *Beams* of the second Deck.

FIGURE VI.

Shews distinctly and successively the Parts or Members of a Ship, which give it the Breadth and Depth it must have backwards.

1. The *Carline*.
2. A *Rib* placed backward and round inside.
3. *Flat Ribs*.
4. A *Rib* half backward, it has less Cavity than those quite backwards.

Note, That we see in this Figure, that the *flat Ribs* are in the Middle; that those placed backward follow them; and those quite backwards are placed at the Extremities of the Ship.

FIGURE VII.

Represents,

1. The *Port-Holes*, bandwise, on both Sides of the Ship.
2. Two *Port-Holes* at the Stern.
3. *Bands*, Pieces of Timber-work. There are several Sorts of them, and are placed in different Parts of the Ship, as well to join the Members thereof, as to strengthen and keep up the whole Structure.
4. The *Futtocks*, which support the Deck.
5. The *Bindings* of the *Scupper-Holes* of the lower Deck, we have already observed, that they must be 19 Inches broad, and 5 or 6 thick at the first Deck.

Note, That here follows a Rule for the Thickness of the *Side Planks*, mention'd in the above-described Figures.

| The Side Planks of the Bottom of a Ship, from | Feet. | Thickness. Feet in Length, from the Stem to the Stern-Post, must be |
|---|------------|--|
| | 40 to 60 | 2 Inches thick. |
| | 60 to 80 | 2 1/2 |
| | 80 to 100 | 3 |
| | 100 to 120 | 3 1/2 |
| | 120 to 140 | 4 |
| | 140 to 160 | 4 1/2 |
| | 160 to 170 | 4 3/4 |

Note also, That before we proceed further, I'll explain here the two Figures of the fore Part of a Man of War, represented in my Plate; those two Figures being cut in a Manner, that the outside Parts which do not appear in one, are represented very distinctly in the other, and are marked with the same Cyphers or Letters, viz.

S. The *Neck-Piece* of the Cutwater, which must have 27 Feet in Length, and 5 in Breadth, to be proportion'd to a Man of War, which has 145 Feet in Length from the Stem to the Stern-Post, 36 Feet broad, and 15 deep.

R. R. The *Futtocks* of the Neck-Piece. The Needles of the Cutwater comprized between the Neck-Piece and the Yard-Bearers, and which jut out much into the Sea, are here more rounded than they were formerly.

T. The *Holes* or *Passenings* of the Tacks of the Fore-Mast.

V. V. The *Stem*.

W. The *Keel*.

X. The Hole thro' which passes the Tack of the Bowsprit.

P. The *Hawse Holes*.

Q. Q. The *Girts*.

O. O. The *Side Planks*, which are put two and two between the Girts.

N. The *Threshold* of the Port-Hole, or lower *Threshold*.

M. The *Valves* of the Port-Holes of the large Battery. Large Men of War have commonly three Batteries.

L. The second *Battery* is placed above the lower, or at the middle Deck; and the third on the upper Deck. Each Port-Hole must have its *Drague* and its Crane; which are big Ropes, serving to approach, and draw back the Cannon, and likewise to stop the Recoil, so that a Piece of Cannon may not recoil, when it is fir'd, further than half Deck.

F. K. *Embrasures* to level the Cannon.

I. The *Cadenes* of the Shrowds, which are Iron-Chains, at the End whereof is placed a *Ram's Block* (g) to make the Shrowds tight. They serve to so many other Things, that for the Rigging of a single Ship, we take most commonly 13 Dozens of them.

E. E. The *Yard-Bearers* 1, 2, 3. which are above the Cutwater, the uppermost is 8 Inches broad backwards, and 4 1/2 thick; 5 Inches broad forwards, and 3 1/2 thick. The second 6 Inches broad, and 4 1/2 thick backwards; 4 1/2 broad, and 3 1/2 thick forward. The lowermost 6 1/2 broad, and 4 Inches thick backward; and 5 Inches broad forwards.

4. The Door of the Fore-Castle.

1. 2. The Ornaments of the uppermost Part of the Poop.

3. 5. Shew the Sheathing of the Boards, which make an End of covering the hind Part of the Ship, as far as the *Platboard*.

Note, That here follows a more particular Description of several Pieces or Members of a Ship, which have already been mentioned; beginning at the Stern.

The *great Block* of the *Driffe*.—It is a large square Piece of Timber, placed upright on the *Carline*, whence it rises over the Deck. At the upper End of that Piece of Wood, there are three or four Spinning Wheels of Pulleys on the same Axle-Tree, on which the great Clew-Lines pass; the main Block of Clew-Lines serve to the Main-Yard.

The *main Capston*, 2. fig. 17. is a wooden Machine placed on the first Gun-Deck, and which rises 4 or 5 Feet above the second; it is called *double Capston*, because it serves to raise the Anchor, and for other Uses, which I'll mention, when I'll explain its Figure.

The *little* or *simple Capston*, placed on the second Deck.

1. The *Dogue* of *Amure*. There is one on each Side of the Ship. It is a Hole with a *Taquet* inside, and a Frame outside. One of those Holes is Larboard of the Ship, and the other Starboard, on the flat Body at the Head of the Main Mast, to tie the *Couets* of the Main-Sail. The Distance between the *Etambraie* of the Main-Mast, and either of the *Dogues* of *Amure*, is equal to the Length of the main Beam.

3. *Chains* of the Shrowds.

4. *Mast*; it is a great Tree, or a long Piece of Wood placed in a Ship, to which the Yards, Sails, and Tackles necessary for the Sailing of the Ship, are fastened.

5. *Chouquet*.

6. It is a triangular Piece of Wood placed on the End of the Stays, and which join them with the Stern.

7. *Taquet* of the Key of the Stays. It is a Piece of Timber, placed under the Key of the Stays, between the Counter-Post, and the Counter-Stern-Post.

8. The *Ladder of the Poop*; which is made of Cord, and hangs at the Stern of the Ship, for the Commodity of the People of the Shallop, and to make Use of it in a Tempest.

FIGURE XI.

Shews,

1. A simple Pulley; which is a *Muffle* where there is only a single Pulley.

2. A *Crane Pulley*, which is a double Muffle, where there are sometimes two Pulleys over one another, and sometimes even four.

3. *Pulleys of Caliores*, which are Pulleys with two or three Wheels on the same Axle-tree.

4. *Common Pulleys*; which is a round Body made of Wood or Metal, in Form of a Plate, with a hollow all round it, for a Rope to run round. The Pulley is set in what's called a *Scarf* or *Muffle*; and by that Word *Pulley* is understood the whole together, viz. the *Scarf*, the *Pulley*, the *Wheel*, and the *Axle-tree*.

5. *Cut*, or *dented Pulley*, is a Pulley which has its Scarf sloping on one Side, to run the Bow-line into it, when it is necessary to hale it.

6. *Hawse-Block*, it is a large square Piece of Timber, placed upright on the Carline, whence it rises over Deck. At the upper End of that Piece of Timber, there are three or four Wheels of Pulleys on the same Axle-tree, over which the great Drifts run.

7. The *Block* of the *Driffe* of the Mizen-Mast, the Pulleys whereof must be eight Inches broad, with proportionable Cordages.

8. The *Scuttle*: It is a Kind of little Platform, supported by wooden Bars, and which runs, in jutting out, round the Cap of the Mast: Though most commonly the largest Ships have but four *Scuttles*, viz. the Main-Scuttle, the Fore-Mast-Scuttle, that of the *Boltsprit*, and that of the Mizen, and there are but Bars at the other Masts, those Bars are notwithstanding called *Scuttles*. The *Scuttles* serve for working the Ship, wherefore the Sailors go up to them. They serve likewise to fasten the Stays, Shrowds, and several other Cordages. A Sailor is kept there in Centry, that he may see at a greater Distance.

The *sixteenth Figure* represents,—1. The *Etambraie* of the Main-Mast. The *Etambraies* are round Holes made in the Decks of a Ship, to pass the Masts through them, or they are two large Pieces of Wood which embrace a round Hole made in the Deck, through which the Mast runs, the better to strengthen the Deck in that Place, and keep the Mast more steady.

2. The *Etambrie* of the Fore-Mast.

3. The *Etambrie* of the Capstern.

4. The *Pump*.

5. The iron, or wooden *Rod* of the Pump.—It holds the Apparatus.

6. The *Girt of Viboard*, is a Girt a little smaller than the others, which runs all along the Ship upwards.

7. The *Girts*, are long Pieces of Wood, put in divers Places a-top of the Ribs of a Ship, as well for Ornament as Necessity. The Chiefs of them are over the *Acastillages* at Breast-high. There are likewise some of them on the Pediment of both Castles.

The *twelfth Figure* shews,—1, 2. The Figures of the *Bits*.

1. The first shews the *Bits*, such as they are seen backwards; *b b*, the *Pillars* or the *Bits*; *c c*, the *Head* of the *Pillars*; *d d*, the *Holes* which serve for the large *Iron Pegs* when the Cable is on the *Bits*, to stop it, and hinder it from spinning; *e e*, the *Boltsprit*; *g g*, the *Deck*; *h h*, the *Head* of the *Bolter* which is of Deal.

This first Figure of the *Bits* has its Proportions, that it should not rise above the first Deck. But if it was to be carried as far as the second, the *Pillars* should be kept longer downwards.

The second Figure shews the *Bits* on the fore Part of the Ship, the better to discover the *Futtocks* which do not appear at the Stern; *b b* the upper Branches of the *Futtocks* which extend over the Deck, as far as the Head of the *Bolter*; *c c*, the lower Branches of the *Futtocks*, which cannot be made too long, and can be extended as far as the *Guerlandes*, which are those large Pieces of Carpenter-Work bent, and placed square-wise on the Stem, above, and under the *Hawse-Holes*, to form the joining of the fore Part of the Ship, and keep up the Side-Planks; *d d d d*, *Pegs* with *Rings* which run through the Ribs and Beams, and are fastened with Pins.

3. The *Pillars* of the *Bits*.

4. *Hawse-Holes*. Commonly there are two *Hawse-Holes*, one on each Side of the Stem; and sometimes four, two on each Side the fore Part of the Ship, Star-

board and Larboard of the Stem. In Men of War which have two Gun-Decks the *Hawse-Holes* are pierced under the first or lower Deck.

5. The *Great Level*.

The *fifteenth Figure* shews,—1. The *Arbitratre*, *Epistyle*, which is a Piece of Timber placed on Columns instead of Arcade, and is the first and principal, which support the others.

2. *Bars* of the Capstern, are certain square Pieces of Wood, serving to turn the Capstern round.

3. The *Carline*. I have said already, that it is the longest and biggest Piece of Wood, employ'd in the Hold of a Ship.

4. The *Girts*, already mentioned, are placed parallel ones to the others. The Sailors find a Convenience in them when they want to get into the Ship to clean it.

5. *Counter-Girts*, are those placed over the *Tyllar-Transom*.

6. The *great Carline*, or *Zarline* of the Main-Mast.

7. The *Carline* of the Foot of the Fore-Mast.

8. The *Carline* of the Mizen-Mast.

9. The *Carline* of the Capstern.

10. The *Straps*, which are Pieces placed over the Binding, as the *Allonges* are under it, to strengthen large Ships which carry much Cannon. The larger Ships which have two Rows of Port-Holes want double Straps backwards, and still more under the Fore-Castle, because of the Anchors, which are drawn up there, and shake much that Part.

The *fourteenth Figure* represents,—1. The *Tyllar-Transom*, already so often mentioned.

2, 3. *Porques* of the Bottom, situated about the Middle of the *Carline*, and are less bent, and flatter than the other *Porques*, because the Bottom of the Ship is flatter about the Middle of the *Carline*.

4. *Bindings* of the *Scupper-Holes*.

5. *Flat Boards*, placed over the Ends of the reverse Lengthening close to the *Girts*.

6. *Thresholds* of a Port-Hole, or lower Threshold, is a Board which being put over the lower Part of the Port-Hole, covers the Thickness of the Sides, and prevents the Water from rotting the Members of the Ship.

7. Some call likewise, *Thresholds*, the cross Piece of Timber, which rests on the two upright Beams, and into which enters the Iron Work.

8. The *Vaigres* of *Empature* of the Floor-Timbers and *Knees*, are those which follow the *Vaigres* of the Bottom, and are risen above it, to form the Roundness on both Sides.

9. The *Fargues* are Boards risen on that Part of the *Flatboard* called the *Bule*, to serve instead of Guard-Corps, the better to defend the Deck, and to steal from the Sight of the Enemy what passes on Deck. The *Belle*, or *Embelle*, is that Part of the upper Deck which runs between the Shrowds of the Fore-Mast and the main Shrowds, and which having its Side less risen than that of the other Parts of the Ship fore and aft, leave that Part of the Deck almost quite open at its Flanks. It is then to cover that Place that the *Fargues* are used. They are took off when the Fight is over, as well as the Guard-Corps, which are Mattes, or Textures made of Ropes, and placed on the upper Sides of Men of War, to shelter Soldiers against the Musketry of the Enemies.

11. The *Gallow* of the *Lever* which serves to draw the Water out of the Pump.

Note, That we have seen in the preceding Figures, the Application of the Models made to shew the Length, Breadth, and Caliber of the Members and Parts of a Ship, when it is to be built, to be put on the Stocks, and in a Condition to be launched, which is done in the following Manner.

To place well a Keel on the Stocks (fig. 7.) the *Stocks* must be placed at 6 Feet distant from one another, taking Care that the Middle of the *Keel* should rest directly on the Middle of the *Stocks*. The bigger *Tins* designed to keep the *Keel* almost in an Equilibrium when the Ship is launched, must be placed at 5 Feet of the Length of *Keel*, taking it backwards, and from the Head of the *Keel*. The *Tins* more backward need no Wedges, because as soon as the Ship leans a little forward, it rests less on those Stocks, and they fall of themselves.

elves; but Wedges must be put at all the other Stocks, from the biggest forwards. Some Carpenters make the Fore-mast Stock, which is under the Stem, of a Wood very easy to split, and to launch the Ship, they dig up a little of the Earth round the Stock, and under it, so that it sinks a little, and then breaks it in Pieces.

When the *Keel* is well placed on its Stock, a Line is drawn through its Middle, from fore to aft, to see if it be not arched. Most Carpenters make it arch by 6 or 8 Inches underneath, according to its Length, pretending that it straitens again when it is in the Water, because Ships being much narrower at their Extremity than in their Body, and consequently less supported there by the Water, the Extremities seldom fail sinking a little at first, and afterwards, when the Ship grows old, they continue to sink a little by Degrees, and the *Keel* bends Inside, which produces a very disagreeable Effect, and sometimes a dangerous one. In placing the *Keel* on the Stock, Care is taken to keep it higher backwards, and as high as is necessary to launch easily the Ship to the Water, and before the *Tins* are put under the *Keel*, it would be very proper to make a Bed of good Boards 10 or 12 Inches broad, or more, to place the *Tins* upon it, rather than on the the Ground. All this may be easily understood, in examining *Figure 7.* of my Plate, where the Letter A shews the Ship on the Stocks, with the following Circumstances.

1. A Scaffold made slanting for the Workmen to go in, and come out of the Ship.
2. An Aperture left for the Passage into the Ship, of the biggest Pieces of Timber, which must serve for its Construction.
3. Pieces of Timber disposed at a Level, and supported by other perpendicular ones, in a Dock, *Dutch* Fashion, or the Ground even with the Water, to facilitate the launching of the Ship, in the Manner represented under the Letter B.
4. *Tins* placed on the Ground, or on Boards to support the *Keel*.
5. The Stocks, or Bed where the *Tins* and Ship rest.
6. *Wedges* greased, and drove under the *Keel*.
7. *Coites*, or long Pieces of Timber placed parallel under the Ship, to carry it when taken off the Stocks, in order to launch it to the Water. The *French* make use of two indented Pieces of Wood, which they call *Colombiers*, and which go to the Water along with the Ship; and when the Ship begins to float, the *Colombiers*, which are tied to it with Ropes, floating likewise, are withdrawn. But among the *Dutch* the *Coites* remain in their Place, and the Ship sliding over them, goes alone to the Water. The *Dutch* have this Particular besides, that they put each Side on the *Coites*, the *Wedges* which serve to make the Ship slide on the *Coites*, and launch it.
8. The *Calione*, and Rope to stop the Ship and draw it forwards and backwards; as Necessity requires it. Lastly, it is seen in the Figure B, how far the Construction of a Ship is advanced when it is launched. It is perfected afterwards by erecting a Scaffold, which reaches from the Stern of the Ship to the Shore, where there are Quays made for that Use.

Note, That the Pit, Pond, or Creek, where Ships are built or repaired, is called *Dock*. This is of two Sorts; a dry *Dock* where the Water is kept out by great Flood-Gates till the Ship is built, or repaired, but afterwards can be easily let into it again to float and launch her; a *wet Dock*, is any Place in the Ooze, out of the Tide's Way, where a Ship may be haled in, and so dock herself, or sink herself a Place to lie in.

Note, also, That there is another Operation to be made on a Ship, which has not been mentioned yet, and which is that of careening it.

To *careen* a Ship, is to lay it on one Side, to calk, stop up Leaks, refit or trim the other Side.

A Ship is said to be brought to a *Carreen*, when the greatest Part of her Lading, &c. being taken out, and a Pontoon, or another Vessel lower than herself, laid by her Side, she is haled down to it as soon as the Occasion requires, v. gr. a fourth or fifth Strake; and there kept

by the Weight of Ballast, Ordnance, &c. as well as by Ropes, lest it should strain her Masts too much.

This is done with Design to trim her Sides or Bottoms, to calk her Seams, or to mend any Fault she has under the Water.

This Operation of *Carreening* is seen, *fig. 8. Nav. Arch.* in those Figures A shews a Ship which is careened on the Starboard Side; and B, a Ship careened on the Larboard Side.

C, Heating made with small Wood, while the *Carreen* is given to the Ship. The Heat must not be spared.

D, The Tar wherewith the Wood of the Ship, and the Cordages are imbibed, that they may resist the Water, Wind, and Heat of the Sun.

E, That Tripod or Candlestick, which are three Stakes driven very far into the Ground, in the Middle whereof is a Fourth, placed like a Candle in a Candlestick. It is called Stool and Tripod, because of its Likeness to the Seats with three Feet, used in *Holland* by most Workmen. To this are fastened the Ropes which serve to support the Ships when they are put on their Sides to be careened; to which are fastened likewise the *Atrapes*, which are large Ropes to hinder a Ship from lying too much on its Side, while she is in *Carreen*.

Note, That our Man of War thus entirely finished, must next be fitted with two Boats, one called the *Shalop*, or *Long-Boat*, and the other the *Canow*.

The *Shalop*, or *Long-Boat*, serves to carry People on board the Ship, or on Shore, or from one Board to another. It serves likewise to carry the Towing-Anchor, when it must be cast. To carry on board the Munitions and Provisions, the Ballast, and other heavy Burthens, to save the Crew and Cargo in case of a Shipwreck, or any other Misfortune at Sea, and to a great Number of other particular Uses. In my Plate of *Naval Architecture*, *fig. 9.* is seen a *Shalop* turned upside-down, to shew from the Top the Situation and Order of its inward Parts, viz.

- A. The *Ribs*.
- B. The *Knees* of the Bottom.
- C. The *Carlines*.
- D. The *Serrebanquieres*.
- E. The Benches where the Rowers sit.
- F. The *Deck*, and the Bench of the fore Part of the *Shalop*.
- G. The Benches joined round the hind Part Inside, for the Conveniency of those who are in it.
- H. The *Floor*, or Bottom of the *Shalop*.
- I. The *Taquets* with their *Echomes*, to preserve the Boards against the rubbing of the Oar. In their stead is placed, in smaller Boats, two *Tolets*, which are small wooden Pegs to place the Oar between.
- K. The *Freeze* and *Girt* of the Viboard.
- M M, The *Crowning* of the *Shalop*.
- N N, Small *Futtocks* to keep the Benches of fore and aft steady.

O O, A Rool of Defence, to defend the Stem from striking against large Vessels.

P, The Pegs to hang the *Soals* or *Derives*.

Q, *Hole* in the *Carline*, with a Notch in the Bench to place the Mast.

The *Canow*, is a Kind of small *Shalop*, designed for the same Uses as the *Long Boat*. The tenth Figure of my Plate shews a *Canow* turned upside-down like the *Shalop*, wherein are represented all the inside Parts thereof, and distinguished by Figures. The Figures which are not visible in the *Canow* turned upside-down, are easily seen in the perpendicular Section of the same *Canow*; viz.

1. The fore Part of the *Canow*.
2. The hind Part.
3. The *Ribs*.
4. The *Knees* of the Bottom.
5. The *Carline*.
6. The *Serrebanquiere*.
7. The Board.
8. The *Taquets* with their *Echomes*.
9. Pieces of Wood placed behind the *Carreen* to place the Oar to row the *Canow*, either to the Ship or to Shore.

10. The

10. The Deck and Bench of the fore Part of the Canow.

11. The *Cajute*, and Benches of the Stern.

12. *Taquets* to fasten the Soals, when the Wind serves.

13. The Hole to place the Mast.

14. The Futtocks to strengthen the Benches fore and aft.

15. The Virevaut.

16. The Hatch.

17. 18. The Length of the Canow, which is most commonly as much as the Breadth of the Ship to which it is to serve.

Note, That in *England* and *Holland* they have a Kind of small Vessel, called *Yacht*; in *England* for Pleasure and War; and in *Holland* for the Service of the East-India Company, for that of the Commissioners of the Admiralty, and for the frequent Deputations from the States General, and from the Cities of the Seven United Provinces. There are some of those *Yachts* which are 66 Feet long, 19 broad, and 6 deep, under the Scupper-Holes.

Note also, That on the *Mediterranean*, the *French*, *Italians*, *Spaniards*, &c. have *Galleys*.

A *GALLEY* is a low built Vessel, going both with Oars and Sails.

Note, That the *Galley* is called by the *Greek* Authors under the Eastern Empire, *Γαλαξ* and *Γαλεξ*; and by the *Latin* Authors of the same Time *Galea*; whence the modern Denomination. Some say it was called *Galea*, on Account of the Figure of a Cap, or Helmet, which it bore on its Head, or Prow, as *Ovid* attests, *De tristib.* The *French* call it *Galere*, by Reason they say, that the Top of the Masts are usually cut in Manner of a Hat, which the *Italians* call *Galero*. Others derive both *Galea* and *Galere* from a Fish, by the *Greeks* called *Γαλεδης*, or *ξιφιας*; and by the *English* *Sword-Fish*, whose Shape this Vessel resembles. Lastly, others derive *Galley*, *Galea*, *Galere*, *Galeasse*, &c. From the *Syriack* and *Chaldee*, *Gaul*, and *Gallin*, a Man exposed on the Water, or in a Vessel of Wood.

Galleys are distinguished into *Light* and *Bastard Galleys*.

Light Galleys are built in the ancient Manner, having the Poop narrow and sharp.

Bastard Galleys are the common *Galleys*, which have the Poop broad. They commonly carry only two Masts, viz. the *Mestre* and the *Trinquet*, which they take off as Occasion requires.

We call *Capitane Galley*, the principal *Galley*, not only of the maritime Powers and sovereign States, which have no Title of Kingdoms, but likewise of some Kingdoms annexed to a greater: And *Patronne Galley*, the second *Galley* of *France*, of *Tuscany*, and of *Malta*, and the third of the maritime Powers, who besides a *Real* have a *Capitane*, such as the ecclesiastical State, *Spain*, and *Venice*.

But we call *Real Galley*, the principal *Galley* of an independant Kingdom, and likewise the first of the Pope's *Galleys*; because all the crowned Heads of the Catholick States, give the Precedency to his Holiness.

In the Construction of *Galleys*, they commonly give 120 Palms or Hand-breadth of Length from one *Capion* to the other; which is said in Ships from the Stem to the Stern Post. They make the principal Rib (which is the Rib of the Middle of the *Galley*, and likewise the biggest, called by the *Italians* *Stamenale*) 25 Palms broad. They call Cutwater *Sperone*, to which are given 22 Palms in Length.

Here follows a Description of the principal Parts of a *Galley*, viz.

The *Rudder*, called by the *Italians* *Temone*, is suspended to the Stem with two Hooks, like in other Vessels.

The *Main Mast* is 90 Palms long; big at the Bottom 2 Palms, and a-top 1½. The *Italians* call it *Albero Maestro*.

The *Fore Mast*, called by the *Levantine* *Trinquet*, and the *Italians* *Albero de Tronchetto*, is 54 Palms long, big at the Bottom 1½, a-top 1 Palms.

The *Main Yard* is 112 Palms long, big at the lower End, and 7½ at the upper End. The *Yard* of the Fore Mast is less long, according to the Proportion which is between both Masts, or from 90 to 54.

The *Main Sail* is by the *Italians* called *Antenna*.

The *Gabier*, is the Sailor who stands Centry on the Scuttle, called *Gabie* on the *Mediterranean*. There are the great *Flag*, the *Banniere*, the *Flag of the Trinquet*, the *Weather Cocks* of the Fore Mast, the *Banner* of the Fore Mast, the *Standard*, which distinguishes the Nation, &c.

The *Place* of the Steerer.

The *Place* of the Captain in the *Dunette*.

The *Courser*, or *Corfia*, which is the Passage from the Prow to the Poop, thro' the Rows of Galley-Slaves.

The *Place* of the two *Comites*, or Officers of the Galley-Slaves.

The *Place* of the Trumpeters.

The *Cutwater* of the *Galley*, in *Italian* called *Sperone*.

The *Place* of the *Courser*, which is a large Piece of Cannon in Battery, lodg'd on the fore Part of the *Galley*; it is commonly a 33 or 34 Pounder.

Lighter Cannons, which are commonly two Bastard-Pieces, and two others 5 or 6 Pounders. But the *Galleys* of the King of *France* carry only at present in their Stead, two 25 or 26 Pounders.

The Holes through which the Ropes run, which serve to lift up on Board the Cannon, and other heavy Burdens.

The *Anchor* or *Grapler* of the *Galley*.

The outside and inside Parts of the *Galleys*, and what they contain, are,

1. The *Prow*.

2. The *Poop*.

3. The *Place* of the Captain.

4. The *Bandins*, which are Places for the Knights-Volunteers.

The *Oars* of a *Galley* must be made of Beech, 28 Palms long, and have each 5 Men to row. The Palm is a Measure of 9 Inches.

Galleys keep usually towards the Coasts, tho' sometimes they cross the Sea.

The King of *France* keeps up 40 *Galleys* for the Use of the *Mediterranean*; the Arsenal whereof, which is a very magnificent one, being at *Marseilles*: The General of the *Galleys* bears a double Anchor, placed in Pale behind the Escutcheon of his Arms, as a Mark of his Authority. The present General of the *Galleys*, is the Chevalier d'Orleans, Grand Prior of *France*, of the Order of *Malta*, a natural Son of his Royal Highness the late Regent of *France*, Philip Duke of Orleans, by Mademoiselle de Celi.

Note, That *Galleys*, in *Latin*, are called *Biremes*, *Tiremes*, and *Quadrيرهmes*, not on Account of their having two, three, or four Ranges of Oars before one another, as many learned Men have imagined, and particularly *Scaliger* and *Snellius*, tho' this last has wrote excellently on the Subject of *Navigation*; for this were impracticable: Nor yet on Account of their having but two, three, or four Oars; for then they would want Strength: But by Reason there were two, three, or four Rowers fastened to each Oar; as is very well shewn by F. de Chales a Jesuit, in his Art of Sailing. The Error was occasioned by some ancient *Galleys*, represented on Medals, or Basilio-Reliefs, wherein are several Ranges of Rowers placed one each other: But all the Mathematicians, Philosophers, and Ship-builders, look on this as mere Vision; inasmuch as *Pliny* makes mention of *Galleys* of 15, 20, 30, 40, or 50 Rows of Rowers, so that if they were ranged over each other, tho' we were only to allow four Feet for each Deck, there would be a Distance of 160 Feet between the lowest Rowers and the highest. And yet we are assured, that the highest Vessel ever built, was only 72 Feet high. *Scaliger* affirms, that the first *Tiremis*, or *Galley* of three Stories, was built at *Corinth*; and is of Opinion, that what *Pliny* calls long Ships, were what we call *Galasses*; the largest whereof was that of *Argonautus*. *Vegetius* mentions a *Galley* of five Decks; and *Mennon* another with eight and only one Man to each Oar.

Note also, That the *French* have their *Galley* rowed by Criminals, condemned to it for some capital Crime.

real or accounted such, they have committed. Those unfortunate Wretches are adjudged to serve the King as Slaves, on board the Galleys, either for ever, or for a limited Time. A Man condemned to the Galleys for Perpetuity, is dead in a civil Sense. He cannot dispose of any of his Effects; cannot inherit; and if he be married his Marriage is null: Nor can his Widow have any of her Dower out of his Goods. The Ecclesiastical Courts cannot sentence to the Galleys: It is out of their Jurisdiction and Resort. By an Ordinance of Charles IX. in 1564. the Judges are enjoined not to condemn a Criminal for less than 10 Years. And Henry III. by another in 1579. enjoins the Captains not to detain their Galley Slaves after their Time is expired; but this Law is not observed; for after an unfortunate Slave has served the Time he was condemned for, he must serve besides, before he can recover his Liberty, so many Years for the King, so many for the Queen, so many for the Dauphin, and thus almost *in infinitum*; so that a Man condemned for ten Years to the Galleys, has as little Hopes of ever recovering his Liberty, as one who is condemned for a hundred and one Years.

Note again, That the Invention of Ships is very antient, since God himself gave the first Model thereof to Noah, for the Building of his Ark, to save the human Race from the Waters of the Deluge. The first celebrated Ships of Antiquity, besides this Ark, are that of *Ptolemy Philopater*, which was 280 Cubits long, 38 broad, and 48 high; it carried 400 Rowers, 400 Sailors, and 3000 Soldiers. That which the same Prince made to sail on the Nile, we are told, was half a Stadium long. Yet these were nothing in Comparison with *Hiero's* Ship, built under the Direction of *Archimedes*; on the Structure whereof *Moschion*, as we are told by *Snellius*, wrote a whole Volume. There was Wood enough employ'd in it to make fifty Galleys; it had all the

Variety of Apartments of a Palace; Banqueting-Rooms, Galleries, Gardens, Fish-Ponds, Stables, Mills, Baths, a Temple of *Venus*, &c. It was encompassed with an Iron Rampart, eight Towers, with Walls, and Bulwarks, furnished with Machines of War; particularly one, which threw a Stone of 300 Pounds, or a Dart 12 Cubits long, the Space of half a Mile; with many other Particulars related by *Athenæus*. Among modern Ships, the most celebrated, are the *Royal Louis*, built at *Toulon* in *France*, and at present at *Brest*, she carries 120 Guns, but is so heavy, and sails so slow, that she has never made any other Voyage but from *Toulon* to *Brest*, where it has remain'd since, and is only kept for Parade, and for a magnificent Piece of *Naval Architecture*; all the Cannon are Brass, the Apartments inside, are sumptuous, and outside it is gilt level with the Water. And another built at *Woolwich* in *England*, in 1701; the Dimensions whereof, whence those of other Rates may be deduced, are as follows: The Length 210 Feet (that of the *Royal Louis* is 250) Number of Guns 110; Number of Men 1250 (that of the *Royal Louis* 2000) Number of Tuns 2500; Draught of Water 22 Feet; the Main-Sail, in Length 54 Yards, Depth 19; the Main-Mast, in Length 39 Feet, in Diameter 38 Inches; Weight of the Anchor 82 C. 1 q. 14 lb. Cable in Length 200 Yards; Diameter of the Cable 22 Inches. The Expence of Building a common first Rate Ship, with Guns, Tackling, and Rigging, is computed at 60,000*l.* Sterling.

Note besides, That having finished our Ship, and fitted her with all its Rigging, Tackling, &c. I shall next sail in her to some Parts of the World; but as this cannot be done without the Assistance of the Art of *Navigation*; we'll learn that Art in my next Treatise.

NAVIGATION.

NAVIGATION, is the Art or Act of Sailing, or of conducting a Vessel from one Place to another the safest, shortest, and most commodious Way.

This Art, in the full Latitude of the Word, comprehends three Parts. 1. The Art of constructing or building Ships, taught in the preceding Treatise. 2. The loading of Ships. And, 3. The conducting or guiding of Ships thro' the Sea, which is in a peculiar Sense called *Navigation*.

In this restrained Sense of the Word, *Navigation* is either *common* or *proper*:

Common NAVIGATION, usually called *Coasting*, is when the Ports are on the same, and very neighbouring Coasts; and where the Vessel is seldom out of Sight of Land, or out of Reach of Sounding.

In this, little else is required, but an Acquaintance with the Land, the Compass and sounding Line.

Proper NAVIGATION, is where the Voyage is long, and out in the Main Ocean.

In this, besides the Requisites in the former, are likewise required the Use of *Mercator's Chart*, *Azimuth*, and *Amplitude Compasses*, *Log-line*, and other Instruments for celestial Observations, as *Quadrants*, *Fore-Staffs*, &c.

Navigation turns principally on four Things, two whereof being known, the rest are easily found from them, by the Tables, Scales, and Charts.

These four Things are, the *Difference of Latitude*, *Difference of Longitude*, the *Reckoning*, or *Distance run*, and the *Course*, or *Rhumb sailed on*.

The *Latitudes* are easily found, and with sufficient Accuracy.

The *Course* and *Distance* are had by the *Log-Line*, or *dead Reckoning*, and the *Compass*.

Nor is there any Thing wanting to the Perfection of *Navigation*, but to determine the *Longitude*. The Mathematicians of many Ages have applied themselves with the utmost Assiduity to supply this grand *Desideratum*,

but hitherto in vain; notwithstanding the magnificent Rewards of several Princes and States to the Discoverer.

Note, That these previously observed; we'll take Care next to embark on board our Ship, but before we set sail, we must provide ourselves with the various Instruments necessary for both a common and proper *Navigation*, as *common Compasses*, *Sounding-Lines*, *Azimuth*, and *Amplitude Compasses*, *Log-Lines*, *Quadrants*, *Fore-Staffs*, *Back-Staffs*, &c. and learn the Use of each of them in particular, beginning by the *common Compass*.

The *common* SEA-COMPASS is an Instrument used by Pilots, to direct the Course of their Ships. It consists of a Box which includes a magnetical Needle, that always turns to the North; excepting for a little Declination, which is various in various Places, and even at Times in the same Place.

In the Middle of the Box is fixed a perpendicular Pivot, which bears a Card or Pasteboard, on whose upper Surface are described several concentrick Circles; the outmost of which is divided 360 Degrees; the other into 32 Points, answering to the 32 Winds.

In the Center of this Card is fitted a Brass Cone, or Cap, a little Concave, which plays at Liberty on the Pivot; and along on the Thickness of the Card is fitted the Needle, which is cover'd over with a Glass, that its Motions may be observed: The whole is inclosed in another Box; where it is sustained by Brass Hoops, to keep the Needle horizontal. See *Table Magnet*.

The Needle, which is as it were the Soul of the Compass, is made of a thin Plate of Steel in Form of a Lozenge: The Middle being cut out, so as to leave nothing but the Extremities and an Axis in the Middle, to which the Cap is fitted. To animate or touch it, it must be rubbed on a good Load-stone: That End intended for the North Point on the North Pole of the Stone; and that for the South Point on the South Pole. In rubbing it,

in rubbing it, Care must be taken to begin first in the Middle of the Lozenge, drawing it gently to the acute Angle of the Lozenge intended for the North, never suffering it to stay at the End when arrived there, nor drawing it back again from the End to the Middle, but rubbing it a second, or even a third Time, in the same Manner as the first, only beginning a little further and further from the North Point: Some say, the Stone and Needle must be so disposed, as that the Needle of the Rub be in the Direction of the Meridian.

The first Thing Pupil Pilots learn on this *Compass*, are the 32 Winds; to which the 32 Points of the *Compass* answer. The Names of those Winds and Points, and the Distances of the Points, &c. from the North are as follow:

| | | From the North. | |
|-------------------------|---|-----------------|--|
| 1. NORTH, | — | 0° 0' | |
| 2. North by East | — | 11 15 | |
| 3. North-North-East | — | 22 30 | |
| 4. North-East by North | — | 33 45 | |
| 5. North-East | — | 45 | |
| 6. North-East by East | — | 56 15 | |
| 7. East-North-East | — | 67 30 | |
| 8. East by North | — | 78 45 | |
| | | From the East. | |
| 9. EAST, | — | 0° 0' | |
| 10. East by South | — | 11 15 | |
| 11. East-South-East | — | 22 30 | |
| 12. South-East by East | — | 33 45 | |
| 13. South-East | — | 45 | |
| 14. South-East by South | — | 56 15 | |
| 15. South-South-East | — | 67 30 | |
| 16. South by East | — | 78 45 | |
| | | From the South. | |
| 17. SOUTH, | — | 0° 0' | |
| 18. South by West | — | 11 15 | |
| 19. South-South-West | — | 22 30 | |
| 20. South-West by South | — | 33 45 | |
| 21. South-West | — | 45 | |
| 22. South-West by West | — | 56 15 | |
| 23. West-South-West | — | 67 30 | |
| 24. West by South | — | 78 45 | |
| | | From the West. | |
| 25. WEST, | — | 0° 0' | |
| 26. West by North | — | 11 15 | |
| 27. West-North-West | — | 22 30 | |
| 28. North-West by West | — | 33 45 | |
| 29. North-West | — | 45 | |
| 30. North-West by North | — | 56 15 | |
| 31. North-North-West | — | 67 30 | |
| 32. North by West | — | 78 45 | |

Note, That North and South, East and West, are called *Cardinal Winds*, as blowing from the four Cardinal Points of the World; and all the others *Collateral*; which are divided by the Moderns into *primary* and *secondary*; and these last subdivided into those of the *first* and *second Order*.—We must observe, in the preceding Table, that the *English* Names of the *primary collateral Winds*, are compounded of the Names of the Cardinal ones, North and South being still prefixed. That the Names of the *secondary collateral Winds* of the first Order, are compounded of the Cardinals, and the adjacent primary one.—That those of the second Order, are compounded of the Names of the Cardinal, or the next adjacent primary; and the next Cardinal with the Addition of the Word *by*.

Next, they learn the *Use of the Compass*, which is *obvious*. For the Course a Ship is to sail in being known by the Chart; and the *Compass* so placed, as that the two parallel Sides of the square Bore be disposed according to the Length of the Ship, *i. e.* parallel to a Line drawn from the Head to the Stern, the Rudder is to be directed accordingly; *v. gr.* if the Course be found on the Chart, between the South-West and South-South-West, *i. e.* South-West $\frac{1}{4}$ to the South; turn the Stern, so that a Line from the South-West, $\frac{1}{4}$ South, exactly answers the Mark on the Middle of the Side of the Bore. This is all that is required.

Note, That the Invention of the *Compass*, in French called *Bouffole*, is usually ascribed to Flavio de Melfi, or Flavio Gioia, a Neapolitan, about the Year 1302.

And hence it is that the Territory of *Principato*, which makes a Part of the Kingdom of Naples, where he was born, bears a *Compass* for its Arms.—Others say, that Marcus Paulus, a Venetian, making a Journey in China, brought back the Invention with him in 1260: What confirms this Conjecture is, that at first they used the *Compass*, in the same Manner as the Chinese still do; *i. e.* they let it float on a little Piece of Cork, instead of suspending it on a Pivot: It is added, that their Emperor Chiningus, a celebrated Astrologer, had the Knowledge of it 1120 Years before Christ: The Chinese only divide their *Compass* into 24 Points.—Fauchet relates some Verses of Guyot de Provence, who lived in France about the Year 1200, which seem to make mention of the *Compass* under the Name of *Marinette*, or *Mariner's Stone*; which shews it to have been used in France near 100 Years before either the *Melphite* or *Venetian*. The French even lay Claim to the Invention from the *Flower de Lis*, wherewith all Nations still distinguish the North Point of the Card.

Thus pretty well acquainted with the *Compass* or *Bouffole*, we'll endeavour next to render ourselves equally familiar with the *Charts*.

A CHART, or SEA-CHART, is a hydrophical Map; or a Projection of some Part of the Sea in Plans, for the Use of Navigation.

There are three Kinds of *Sea-Charts*, viz. *Plain Charts*, reduced or *Mercator's Charts*, and *Globular Charts*.

Plain Charts, are those wherein the Meridians and Parallels are exhibited by right Lines parallel to each other.

These, Ptolemy in his Geography rejects, for the following Faults, though the Inventor judged them of good Use; and Experience has confirmed his Judgment, especially in short Voyages. Their Defects are, 1. That since in Reality all the Meridians meet in the Poles, it is absurd to represent them, especially in large Charts, by parallel Right-Lines. 2. That *plain Charts* exhibit the Degrees of the several Parallels, equal to those of the Equator, and of Consequence the Distances of Places lying East and West, much larger than they should be. And 3. In a *plain Chart*, while the same Rhumb is kept, the Vessel appears to sail in a great Circle; which yet is false.

But notwithstanding these Defects in the *plain Chart*, yet the easiness of its Application has so reconciled it to the Mariners, that it is used almost alone; in Exclusion of the more accurate ones.

These *plain Charts* are made, 1. By drawing a Right-Line, and dividing it into as many equal Parts as there are Degrees of Latitude in the Portion of the Sea to be represented. 2. Another Line is added to it, at right Angles, which must be divided into as many Parts, and those equal to one another, and to the former, as there are Degrees of Longitude in the Portion of the Sea to be represented. 3. The Parallelogram must be completed, and its Area resolved into little Squares; then Right-Lines parallel to the two first will be Meridians, and the others parallel. 4. The Coast, Islands, Sands, Rocks, &c. must be inserted in this Chart, from a Table of Longitudes and Latitudes, in the same Manner as it is done in Maps.

Hence, 1. The Latitude and Longitude of a Ship being given, her Place is easily exhibited in the Chart. 2. The Places to and from which the Ship sails, being given in a Map, the Right-Line drawn from one to the other, makes, with the Meridian, an Angle equal to the Inclination of the Rhumb; and since the Parts intercepted between equidistant Parallels are equal, and the Inclination of the Right Line (drawn from one Place to the other) to all the Meridians or Right-Lines parallel to the first Right-Line, is the same; the Right-Line drawn from one Place to the other truly represents the Rhumb. After the same Manner may be shewn, that this Chart exhibits the *Latus mecodinamicum*, or Miles of Longitude truly.

Therefore it follows, that *Plain Charts* may be used to very good Purpose in directing a Ship, provided Care be taken there escape no Error in the Distance of the Places to and from which the Ship sails.

But if notwithstanding, through Inadvertency, or otherwise, some Errors in the Distances had crept in *Plain Charts*, those Errors can be corrected, by making a Scale in the following Manner:—1. Upon the first Right Line, five Degrees must be transferred from the Map, and divided afterwards into 300 equal Parts, or geographical Miles.—2. On this a small Circle is described to be divided into 90 equal Parts: If then it be desired to know how many Miles make five Degrees in the parallel Fifty; the interval Fifty must be taken in the Compasses, and transferred on to the Diameter formed by the first Right-Line; then the Number of Miles required will here be shewn.

It follows, that if a Ship sails on an Eastern or Western Rhumb out of the Equator; the Miles answering to the Degrees of Longitude, will be found as in the preceding Article.—If it sail on any collateral Rhumb, still the Sailing is supposed to be an Eastern, or Western Rhumb, in an intermediate Parallel, between the Parallel of the Place whence the Ship proceeds, and the Parallel of the Place at which she arrives.

It is true this Reduction, by an arithmetically mean Parallel, is not accurate; yet it is frequently used in Practice, as being accommodated to the Apprehensions of the Generality of Mariners. In Effect it does not err any Thing considerable, if the whole Course be divided into Parts, whereof each does not exceed one Degree; whence it appears advisable, not to take the Diameter of the Semi-circle formed by the first Right-Line, above one Degree, and to divide it, at most, into geographical Miles.

To sail by means of this *Plain Chart*, 1. If both Places be more easterly than the first Meridian, the less Longitude must be subtracted from the greater, and the Remainder will be the Difference of Meridians. If one of the Places be more easterly, and the other more westerly than the first Meridian, the Longitude of the most easterly must be added to the Complement of the Longitude of the most westerly to a whole Circle; the Sum is the Difference of Meridians.

2. The Difference of the Meridians is to be divided into so many Parts as there are Degrees in the Difference of Latitude; or, if the Difference of Latitude be greater than that of the Meridian, into so many fewer.

3. The Minutes of Longitude answering to one Part, must be reduced into Miles of the several Parallels in the former Case, or into Miles of the Parallel, which is an arithmetical Mean proportionable between the two in the latter Case.

4. The Aggregates of these Parts collected into one Sum, exhibit the Departure, or Miles of Longitude.

For Example, suppose the Longitude of one Place 35° , and that of the other 47° ; the Difference of Meridians is 12. Suppose the Latitude of the first 4° and that of the latter 8° , the Difference will be 4° ; consequently we have sailed from the fourth to the eighth Parallel: Therefore dividing 12 by 4, and reducing the Quotient 3° into Miles in the several Parallels 4, 5, 6, and 7; the several Quotients will be $43^{\circ} 71'$, $43^{\circ} 68'$, $43^{\circ} 65'$, $43^{\circ} 59'$: The Sum of which is 174, the Departure or Miles of Longitude required.

But we had observed, at first, that in *common Navigation*, of which we treat at present, nothing is wanted but the *Compass*, and a *Sounding Line*.

A *SOUNDING LINE*, is a Line and Plummert, used in *Navigation*, to try the Depth of the Water, and the Quality of the Bottom.

There are two Kinds of *Lines* occasionally used in *Sounding* the Sea; the *sounding Line*, and the *deep Sea Line*.

The *sounding Line*, is the thickest and shortest, as not exceeding 20 Fathoms in Length; and marked at two, three, and four Fathoms, with a Piece of black Leather between the Strands; and at five with a Piece of white Leather.

The *sounding Line* may be used when the Ship is under Sail, which the *deep Sea-Line* cannot. The Plummert is usually in Form of a Nine-pin, and weighs 18 Pounds; the End is frequently greased, to try whether the Ground be sandy or rocky; and to discover in what Degree of Latitude the Ship is, when a Pilot thinks himself near a Coast, and could not take any Observa-

tion for several Days before; for several Coasts are discovered, either by the Quality, or Colour of the Bottom near them.—Near Banks, Shores, &c. they are to be sounding continually.

Dr. Hook has invented a Manner of *sounding* the Depth of the deepest Sea without any Line, only by a wooden Globe, lighter than Water, to which, at a little Distance, is a Piece of Lead or Stone fixed, by means of a springing Wire in the first, fitted into a Staple in the second. The whole being let gently down with the Stone or Lead foremost, as soon as that arrives at the Bottom, it will stop; but the Ball by the Impetus it has acquired in descending, will be carried a little lower after the Weight is stopped; by which Means the springing Wire will be enabled to fly back and distinguish itself, and re-ascend. By observing then the Time of the Ball's Stay under Water by a Watch or Pendulum, and the Help of some Tables, the Depth of the Sea is found.

In some Experiments made in the *Thames* with a maple Globe, $5\frac{1}{2}$ Inches in Diameter, and weighing 4 Pound and a Half, lin'd with Pitch, and a conical Weight 11 Inches long, the sharp End downwards; at the Depth of 19 Feet, there passed six Seconds, and at the Depth of 10 Feet $3\frac{1}{2}$ Seconds between the Immersion and Emerfion of the Ball. From these Numbers given, the Depth at any other Stays, may be computed by the Rule of Three.

The Instruments we must embark for a *proper Navigation*, or what the *French* call, *un voyage du long cours*, are, as already observed, *Mercator's Chart*, *Azimuth*, and *Amplitude Compasses*, Log-Lines, and other Instruments for celestial Observations, as *Quadrants*, *Fore-Staffs*, *Back-Staffs*, &c.

MERCATOR'S CHART, is that wherein the Meridians and Parallels, are represented by parallel Right-Lines; but the Degrees of the Meridians are unequal, still encreasing as they approach the Pole, in the same Proportion as those of the Parallels decrease; by means whereof the same Proportion is observed between them as on the Globe.

This *Mercator's Chart* is made, 1. By drawing a Right-Line, and dividing it into equal Parts, representing Degrees of Longitude, either in the Equator, or in the Parallel wherein the *Chart* is to terminate.

From the several Points of Divisions, Perpendiculars are erected to represent Meridians; so as Right-Lines may cut them all under the same Angle, and therefore represent *Rhumbs*.—Thus far as in the *plain Chart*.

That the Degrees of the Meridians may have their just Proportion to those of the Parallels, the former are to be increased; in regard the latter continue the same, by reason of the Parallelism of the Meridians.

In Practice, suppose it required to draw a *Mercator's Chart*, from the 40° of North Latitude, to the 50° ; and from the 6° of Longitude to the 18° 1. a Right-Line must be drawn, representing the fortieth Parallel of the Equator; which must be divided into 12 equal Parts, for the 12 Degrees of Longitude the *Chart* is to contain. Then a Line of equal Parts is taken, on a Scale whereof 100 Parts are equal to each of these Degrees of Longitude, and at each Extreme of the Line two Perpendiculars are raised, to represent two parallel Meridians to be divided by the continual Addition of Secants, which are proved to increase in the same Proportion, as the Degrees of Longitude should decrease.

Thus, for the Distance from 40 Degrees of Latitude, one must take $131\frac{1}{2}$ equal Parts from the Scale, which is the Secant of 49 Deg. 30 Min. and will give the Distance from 49 Degrees of Latitude to 50 Degrees. By this Means the Degrees of Latitude will be augmented, in the same Proportion, as the Degrees of Longitude on the Globe decrease.

The Meridians being divided, the *Card* or *Compass* must be added; chusing some convenient Place near the Middle thereof; and drawing from this a Line parallel to the divided Meridians, which will be the North Rhumb; and from this the other thirty-one Points of the *Compass* are to be set off.

Lastly, the Towns, Ports, Islands, Coasts, &c. are to be laid down from a Table of Longitudes and Latitudes, and the *Chart* is compleat.

In *Mercator's Chart*, the Scale changes as the Latitude

is changed: If then, *v. gr.* a Ship sails between the fortieth and fiftieth Parallels of Latitude, the Degrees of the Meridians between those two Parallels, are to be the Scale for measuring the Ship's Way; whence it follows, that tho' the Degrees of Longitude be equal in Extent on the *Chart*, yet they must contain unequal Numbers of Miles or Leagues; and that they will decrease as they approach nearer the Pole, because measured by a Magnitude continually increasing.

This *Chart* is demonstratively true, tho' to Appearance false: It is found by Experience very accurate, and withal easy of Explication. In effect, it has all the Qualifications required to render it of Service in Navigation; yet do the Generality of Mariners decline the Use of it, and rather chuse to keep the old erroneous *plain Chart*.

Note, That this *Chart* has its Name from that of the Author who first proposed it for Use, and made the first *Chart* of this Projection, *N. Mercator*: But the Thought was not originally his own, as having been hinted by *Ptolemy*, near 2000 Years ago; and the *English* say, that the Perfection thereof is owing to their Countryman Mr. *Wright*, who first demonstrated it, and shew'd a ready Way of constructing it, by enlarging the Meridian Line by the continual Addition of Secants.

To sail by Means of *Mercator's Chart*, the following Observations are to be made.

I. *The Longitude and Latitude of two Places given, to find the Departure or Miles of Longitude, in Mercator's Sailing* (which we have already found in *plain Sailing*) the Reduction whereof is much more commodiously performed in *Mercator's Charts*; wherein the Arch intercepted between the two Meridians, is applied to an Arch of the Meridian intercepted between the two Parallels; and the Distance in their Measures, gives the Departure, or Miles of Longitude required.

II. *The Longitude and Latitude of two Places, to and from which a Ship is to sail, being given; to find the Rhumb to be sailed on, and the Distance to be run in Mercator's Sailing.* — 1. The Center of the Mariner's Compass is applied on the Place sailed from, on *Mercator's Chart*, and so as that the North and South Line thereof be parallel to some of the Meridians. 2. The Rhumb of the Compass is marked, wherein the Place sailed to is placed; for this is the Rhumb to be sailed on. 3. The same Rhumb is likewise found by drawing a right Line from the Place sailed from to that sailed to; and with a Protractor, finding the Angles the Rhumb makes with any Meridian it cuts.

Note, That the Rhumb and Distance may also be found after the same Manner on a *plain Chart*.

The same may likewise be found by *Loxadromick Tables*; thus, 1. Chuse a Rhumb at Pleasure, and under the same, in the Tables, find the Longitudes corresponding to the given Latitudes. The Difference whereof, if it coincides with the Difference of the given Longitudes, the Rhumb is well chosen; otherwise another must be pitched on, either more or less oblique, till the tabular Difference agrees with the given Difference. 2. The Rhumb thus found, the Distances answering to the given Latitudes, must be taken from the Tables, and the lesser subtracted from the greater, the Remainder is the Distance sought.

Note, That the same Operation in *plain Sailing* is made in this Manner. 1. One must find the Departure, by the first Case proposed, when I have mentioned *Sailing*, by Means of *plain Charts*. 2. From the Departure and Difference of Latitude, the *loxadromick Angle*, or Rhumb Line is to be found; which is done by this Proportion: As the Difference of Latitude is to the Departure, so is the whole Sine to the Tangent of the Angle of the Rhumb Line. The Distance then to be run on this Rhumb, is to the Departure, as the whole Sine to the Sine of the Angle of the Rhumb.

III. *The Rhumb and Distance sailed being given; to find the Longitude and Latitude of the Place arrived at, in Mercator's Sailing.* — 1. The Mariner's Compass is placed on the *Chart*, with the Center over the Place

sailed from; and the Meridian, and North or South Line, parallel to the Meridian thereof. 2. From the Place sailed from, a right Line is drawn for the Ship's Course: Then the Distance is taken by Parts, in Parts of the Meridian, and is set off upon the right Line, then will C be the Place the Ship is arrived at; the Longitude and Latitude whereof are given by the *Chart*.

To find it by the loxadromick Tables. — 1. Under the given Rhumb, seek the Distance answering to the Latitude of the Place sailed from; and either add it to, or subtract it from the given Distance, as the Latitude of the Place sailed to is greater, or less than that sailed from. 2. Under the same Rhumb, ascend or descend further, till you meet with the Distance corrected. 3. The Latitude answering thereto in the first Column, is the Latitude of the Place sailed to. 4. From the second Column of the Table, take the Longitudes corresponding to the Latitudes of the Places sailed to, and from. Their Difference is the Difference of Longitude of the Places sailed to and from.

Note, That in *plain Sailing*, i. e. by *common Charts*, the Operation is conducted thus. 1. From the *Data*, the Difference of Latitude of the two Places is found; this Difference added to the Latitude of the Place sailed from, or subtracted from the same, the Sum, or the Remainder, leaves the Latitude of the Place sailed to. 2. From the same, the Departure must be found; and thence the Latitude of the Place sailed to.

IV. *The Latitudes of the Places sailed to and from, together with the Rhumb sailed in, being given; to find the Distance and Difference of Latitudes, in Mercator's Sailing.* — 1. The Compass is placed on the *Chart* as in the preceding Case; and from the Place sailed from, the Rhumb Line sailed in is drawn, till it cuts the Parallel of the given Latitude. 2. The Point of Intersection will be the Place arrived in. 3. Hence its Longitude is easily found, and the Distances.

By the Tables. Take both the Longitude and the Distances, answering to the Latitudes of the given Places, out of the Tables; then subtract both the Longitudes and the Distances from each other. The first Remainder is the Difference of Longitude, the latter the Distance of the Places.

Note, That the same Operation in *plain Sailing*, is made by finding the Distance from the Difference of Latitude and the Rhumb given; and from the same *Data* the Departure. This converted into Degrees of a great Circle, exhibits the Difference of Longitude sought.

V. *The Latitudes of the Places sailed from and to, with the Distance given; to find the Rhumb, and the Difference of Longitude, in Mercator's Sailing;* the Parallel the Ship arrives at, is drawn on the Map; and the Distance run reduced into Parts proportional to the Degrees of the Map.

By the Tables; subtract the given Latitudes from each other; and in the Tables seek the Rhumb, under which the Distance run answers to the given Difference of Latitude. Subtract the Longitude under the Rhumb, answering the Latitude of the Place sailed to, and that under the same Rhumb against the Latitude of the Term sailed to, from each other; the Remainder is the Difference of Longitude sought.

Note, That the Operation in *plain Sailing*, runs thus. — A Rhumb is to be found from the Difference of Latitude, and the Distance; and from the same *Data*, the Departure must be found, likewise; which may be also determined from the Rhumb now found, and the Difference of Latitude; or from the Rhumb and the Distance run. Lastly, from the Departure the Difference of Longitude is to be found.

VI. *The Difference of Longitudes of the Places sailed to and from, with the Latitude of one of the Places, and the Distance run being given; to find the Rhumb and the Latitude of the other, in Mercator's Sailing;* a right Line is drawn thro' the Place given in the Map, parallel to the Meridian, making another Line equal to the Difference of Longitude; then another Parallel is drawn which

will be the Meridian the Ship is arrived at. Afterwards with the Interval of the Distance run, an Arch is described intersecting the Meridian, whereby the Place sought is found.

By the Tables. We may take a Rhumb at Pleasure, and under the same, in the Tables, find the Longitude, and the Distance answering to the given Latitude. Adding the given Distance to the Distance found in the Tables, if the Vessel sailed from the Equator; or subtracting, if it sailed towards the same. Withing it therefrom, if it sailed towards the same. With the same Sum, or the Difference, we must enter the Tables; subtracting or adding the Longitude found against it, to that just found. If the Remainder be found the given Difference of Longitudes, the Rhumb is well taken. Otherwise it must be changed for a more, or less oblique one; till the same Operation being repeated, the Remainder be found the Difference of Longitudes; then the Latitude in the first Column, corresponding to the Distance, will be the Latitude of the other Place.

Note, That the Operation in *plain Sailing*, is made by converting the Difference of Longitudes into Miles of Longitude for the Departure; seeking the Rhumb from the given Departure and Distance run; and from the same, and the Rhumb, seeking the Difference of Latitude; which, and the Latitude of one Place being had, the Latitude of the other readily follows.

VII. *The Difference of Longitude, and the Latitude of one of the Places given, together with the Rhumb, to find the Differences run, and the Latitude of the other Place, by Mercator's Sailing:* The Compass must be placed on the Chart as before; and by the given Rhumb the Rhumb-Line is drawn, and a Meridian thro' the given Place, and another with the Interval of the Difference of Longitude, for that the Vessel is arrived at. Where this intersects the Rhumb-Line, is the Place where the Vessel is arrived at. Wherefore if thro' that Place be drawn a Line parallel to the Rhumb-Line, the Distance between both Lines will be the Latitude of the Place. The Distance run is easily reduced into Miles by the Scale.

By the Tables. Under the given Rhumb, seek the Distance run, and the Difference of Longitude answering to the given Latitude. If the Vessel has sailed towards the Pole, the Difference of Longitude is to be added to the given Difference of Longitude; if towards the Equator, it is to be subtracted from the same. In the former Case descend in the Table, and in the latter, ascend; till in the first, the Aggregate, in the latter, the Difference be seen in the Column of Longitude. The Latitude answering hereto in the first Column, is that sought. And from the Distance answering to the Latitude in the first Case, the tabular Distance is to be subtracted. What remains is the Distance run.

Note, That in *plain Sailing*, the Difference of Longitude must be reduced into Miles of Longitude or Departure, as under the first Case. From the Departure and the Rhumb, the Distance run is found; and from these, or from the Rhumb, and the Distance run, the Difference of Latitude. This done, as the Latitude of the one is already had, that of the other is so too.

Note also, That from the Solution of these Cases in *Sailing*, it is evident, some are more easily performed by the *Charts*, than the *Tables*; and that the *Mercator's Charts* are preferable to the plain ones; since in the latter, the Distance is not reduced by the Map, but by a particular Care for that Purpose.

Note again, That in the preceding Operations we have often mentioned *Rhumbs*, and *Rhumb-Lines*: What are those *Rhumbs*? and what those *Rhumb-Lines*?

Rhumb, according to *Arbin*, is a Line on the terrestrial Globe, Sea-Compass, or Sea-Chart, representing one of the 32 Winds, which serve to conduct a Vessel. So that the *Rhumb* a Vessel pursues, is conceived as its Route or Course.

Rhumbs are divided, and subdivided like Points. Thus the whole *Rhumb* answers to the Cardinal Point. The half *Rhumb* to a collateral Point, or makes an Angle

of 45 Degrees with the former. The Quarter *Rhumb* makes an Angle of $22^{\circ} 30'$ therewith. And the half Quarter *Rhumb* makes an Angle of $11^{\circ} 15'$.

A *RHUMB-LINE*, *Loxodromia*, is the Line which a Ship keeping in the same collateral Point or *Rhumb*, describes throughout its whole Course.

The great Property of this *Rhumb-Line*, or *Loxodromick*, and that from which some Authors define it, is, that it cuts all the Meridians under the same Angle. This Angle is called the *Angle of the Rhumb*, or the *loxodromick Angle*.

The Angle, which the *Rhumb-Line* makes with any Parallel to the Equator, is called the Complement of the *Rhumb*.

An Idea of the Origin and Properties of the *Rhumb-Line*, the great Foundation of *Navigation*, may be conceived thus: A Vessel beginning its Course, the Wind wherewith it is driven makes a certain Angle with the Meridian of the Place; and as it is supposed the Vessel runs exactly in the Direction of the Wind, it makes the same Angle with the Meridian which the Wind makes.

Supposing then the Wind to continue the same; as each Point or Instant of the Progress may be esteemed the Beginnings. The Vessel always makes the same Angle with the Meridian of the Place where it is each Moment, or in each Point of its Course, which the Wind makes.

Now a Wind, *e. gr.* that is North-East, and which of Consequence makes an Angle of 45° , with the Meridian, is equally North-East wherever it blows; and makes the same Angle of 45° , with all the Meridians it meets. A Vessel therefore driven by the same Wind, always makes the same Angle with all the Meridians it meets withal on the Surface of the Earth.

If the Vessel sails North and South, it makes an Angle infinitely acute with the Meridian, *i. e.* it is parallel to it, or rather sails in it. If it runs East and West, it cuts all the Meridians at right Angles.

In the first Case it describes a great Circle; in the second, either a great Circle, *viz.* the Equator, or a Parallel to it. If its Course be between the two, it does not then describe a Circle; since a Circle drawn in such a Manner, would cut all the Meridians at unequal Angles, which the Vessel cannot do.

It describes therefore another Curve, the essential Property whereof is, that it cuts all the Meridians under the same Angle. This Curve is what we call the *loxodromick Curve*, *Rhumb-Line*, or *Loxodromy*.

It is a Kind of Spiral, which like the logarithmick Spiral, makes an Infinity of Circumvolutions, without ever arriving at a certain Point, towards which it still tends, and towards which it approaches every Step.

This Asymptotick Point of the *Rhumb-Line*, is the Pole, to which were it possible for it to arrive, it would find all the Meridians conjoined, and be lost in them.

The Course of a Vessel, then, except in the two first Cases, is always a *Rhumb-Line*; which Line is the Hypotheneuse of a Rectangle-Triangle, whose two other Sides are the Ship's Way, or Distance run in Longitude and Latitude. Now the Latitude is usually had by Observation (as we'll see in the Sequel) and the Angle of the *Rhumb*, with one or other of the two Sides, by the Compass.

All therefore that is required by Calculation in *Sailing*, is the Value of the Length of the *Rhumb-Line*, or the Distance run.

But as such Curve Line would prove very perplexing, in the Calculation; it was necessary to have the Ship's Way in a right Line, which right Line, however, must have the essential Property of the Curve Line, *viz.* to cut all the Meridians at right Angles.

The Use of the *Rhumb-Line* in *Navigation*, is as follows. 1. If several Meridians be not very far a-part, the *Rhumb-Line* is divided by the equidistant Parallels, into equal Parts.

Hence, 1. The Parts of several *Rhumb-Lines*, are as the several Latitudes of the Places the Ship sails from and to. 2. Since the Arches form'd thereby are equal in Magnitude, and therefore unequal in Numbers of Degrees, the Sum of the Arches, called the *Latius meodina-micum*,

micum, or Miles of Longitude, is not equal to the Difference of Longitude of the two Places above-mentioned.

2. The Length of the *Rhumb-Line*, is to the Change or Difference of Latitude, in the same Ratio as the whole Sine to the Co-Sine of the Angle of the *Rhumb*.

Hence, 1. The *Rhumb* failed on being given, together with the Difference or Change of Latitude, turned into Miles; the Length of the *Rhumb-Line*, or the Distance from one Place to another upon the same *Rhumb*, is had by the Rule of Three. 2. The *Rhumb-Line* being given, together with the Quantity of the Ship's Way, on the same *Rhumb*; the Difference of Latitude is had by the Rule of Three, in Miles to be converted into Degrees of a great Circle. 3. The Difference of Latitude being given in Miles; as also the Length of the *Rhumb-Line*; the Angle of the *Rhumb*, and consequently the *Rhumb* failed on, is had by the Rule of Three. 4. Since the Co-Sine is to the whole Sine, as the whole Sine to the Secant; the Difference of Latitude is to the Length of the *Rhumb-Line*, as the whole Sine to the Secant of the *Rhumb*.

3. The Length of the *Rhumb-Line*, or of the Ship's Way in the same *Rhumb*, is to the *Latus mecodinamicum*, or *mecodinamick Side*, as the whole Sine to the Sine of the *loxodromick Angle*.

Hence, 1. The *Rhumb*, or Angle of the *Rhumb*, being given, as also the Ship's Way in the same *Rhumb-Line*; the *mecodinamick Side* is had by the Rule of Three, in Miles, *i. e.* in the same Measure wherein the Length of the *Rhumb* is given. 2. In like Manner, the *mecodinamick Side* being given, as also the *Rhumb-Line* or Ship's Way; the *Rhumb* failed in, is found by the Rule of Three.

4. The Change of Latitude, is to the *mecodinamick Side*, as the whole Sine to the Tangent of the *loxodromick Angle*.

Hence the *Rhumb*, or *loxodromick Angle*, and the Change of Latitude being given; the *mecodinamick Side* is found by the Rule of Three.

5. The *mecodinamick Side* is a mean Proportional, between the Aggregate of the *Rhumb*, and the Change of Latitude, and their Difference.

Hence the Change of Latitude, and the *Rhumb-Line*, being given in Miles; the *mecodinamick Side* is found in the same Measure.

6. The *mecodinamick Side* being given, to find the Longitude.

Multiply the Change or Difference of Latitude by six, which reduces it into Parts, of ten Minutes each; divide by the Product the *mecodinamick Side*; the Quotient gives the Miles of Longitude, answering to the Difference of Latitude in ten Minutes; reduce these Miles of Longitude in each Parallel into Differences of Longitude, from a *loxodromick Table*: The Sum of these is the Longitude required.

7. If a Ship sails on a North or South *Rhumb*, it describes either the Equinoctial, or a Parallel thereto.

8. To find the *Rhumb* between two Places, by *Calculation*, or *geometrically*, we have two Canons or Proportions: The first, as the Radius is to the half Sum of the Co-Sines of both Latitudes; or (rather for geometrical Schemes) as the Diameter is to the Sum of the Co-Sines of both Latitudes, so is the Difference of Longitude, to the Departure from the Meridian.

For an Example of the former Proportion. — Let the *Rhumb* be required between Cape *Finister*, Lat. 43° Long. 7° , $20'$, and St. *Nicholas Isle*, Lat. 38° , Long. 352° . The middle Latitude is 40° , $30'$, the Complement 49° , $30'$, and the Difference of Longitude 15° , $20'$; out of these lesser equal Parts, prick down 15° , and describe an Arch with 60° of the Chords, and make it equal to 49° ; then draw an Arch continued to the further Distance, making the nearest Distance the Leg of a right angled Triangle, and the other Leg the Difference of Latitude 5° , which must be pricked from the equal Parts. Thus the Extent measured on the said Parts, shews the Distance to be 13° , $24'$; which allowing 20 Leagues to a Degree, is almost 268 Leagues. Then the *Rhumb Triangle* must be crossed with the Radius; which Extent measured on the greater Chord is almost 22° , the Complement whereof is 68° ; and so much is the

Rhumb from the Meridian between the two Places, amounting to 6 Points, and upwards of 80 Minutes.

For an Instance of the last Proportion. — Let it be required to find the *Rhumb* and Distance between the *Lizard* and *Bermudas*, the Latitude of the *Lizard* being 56° , and that of *Bermudas* 32° , $20'$; or 32° , $4'$, Centesms, and their Difference of Longitude, 55° , two Lines must be drawn at right Angles, and with 60° of the lesser Chords, a Quadrant must be described, and Radius pricked, the second Line drawn will be the Diameter; then counting both Latitudes, the nearest Distance is the Co-Sine of *Bermudas* Latitude; and the nearest Distance to this is the Co-Sine of the *Lizard's* Latitude. Then drawing again another Line, and pricking down 55 Degrees out of the greatest equal Parts, and a Parallel to the Line last drawn, the Distance from the first of the 55 Degrees to the right End of the Parallel is the Departure from the Meridian in the Course between both Places. Making that, therefore, one Leg of a right angled Triangle, prick down 17° , 59 Centesms, the Difference of Latitude between those Places, and at the same equal Parts draw a Line. This represents the Course and Distance between the *Lizard* and *Bermudas*; and the Extent measured on the same equal Parts, shews the Distance to be 44° , 31 Centesms, which allowing 20 Leagues to a Degree, is 886 Leagues.

Note, That to avoid the Errors proceeding from the Inaccuracy of the *Charts*, particularly towards the Poles, because of the great Inequality of the Extent of each Degree of Longitude in those Parts of the World, they have contrived Tables of Reduction of a Degree of each Parallel, from the Equator to the Pole, and Scales proportional to that Reduction, whereby all the Accidents which could happen are prevented. For Instance,

A Ship sails from the Coast of *Norway*, by the 28° of Longitude, and 6° of Latitude, for the Isles of *Orkney*, situated on the North of *Scotland*, which are under the same Latitude, but at the 16° of Longitude: The Pilot consulting his *Chart*, and finding 12° of Difference betwixt those two Places, will judge that there are 240 Leagues Distance, if he don't know how to make Use of the Tables, and Scale of the Reduction of Parallels; therefore having put the Cape to the West, if the Wind proves favourable, he'll esteem the Course of his Ship, at 50 Leagues daily; and expect to reach the Coast the fifth Day of his Departure: Notwithstanding which, because those 12° of Longitude of the 60 Parallel, are worth but 120 Leagues, he'll reach the Coast once sooner than he expected, *i. e.* in two Days and a half; so that believing himself to have Sea-Room, and far from Land, he finds himself either stranded in the Night, or goes to wreck his Ship on some Rocks.

Note also, That the Scales used on the *reduced Charts*, are commonly made on the Sides of the *Charts*, or along the first Meridian, by dividing each Distance comprized between the Parallels into ten Degrees or equal Parts, but that Practice is not exact, because those Degrees should be proportionally unequal, like the Distances of those Parallels, which the nearer the Poles the larger they are. That drawn a-crois the whole *Chart* is more just, provided it makes an Angle of 29 Degrees with the Meridians; and it would be still more perfect, if each Distance was divided proportionally into Degrees.

Note again, That here follows a *Table of Reduction*, of the Minutes of each Parallel, into Leagues and geometrical Paces.

TABLE OF REDUCTION.

Of the Minutes of each Parallel into Leagues and geometrical Paces.

| | 10 Minutes. | | 20 Minutes. | | 30 Minutes. | |
|-----------|-----------------------|-------------------|-----------------------|-------------------|-----------------------|-------------------|
| Parallel. | Leagues of 3000 Paces | geometrical Paces | Leagues of 3000 Paces | geometrical Paces | Leagues of 3000 Paces | geometrical Paces |
| 0 | 3 | 1000 | 6 | 2000 | 10 | 10000 |
| 1 | 3 | 0999 | 6 | 1997 | 9 | 9995 |
| 2 | 3 | 0994 | 6 | 1987 | 9 | 2981 |
| 3 | 3 | 0986 | 6 | 1973 | 9 | 2959 |
| 4 | 3 | 0976 | 6 | 1951 | 9 | 2927 |
| 5 | 3 | 0962 | 6 | 1923 | 9 | 2885 |
| 6 | 3 | 0945 | 6 | 1890 | 9 | 2835 |
| 7 | 3 | 0926 | 6 | 1852 | 9 | 2776 |
| 8 | 3 | 0903 | 6 | 1805 | 9 | 2708 |
| 9 | 3 | 0877 | 6 | 1753 | 9 | 2630 |
| 10 | 3 | 0849 | 6 | 1698 | 9 | 2547 |
| 11 | 3 | 0816 | 6 | 1633 | 9 | 2449 |
| 12 | 3 | 0781 | 6 | 1563 | 9 | 2344 |
| 13 | 3 | 0744 | 6 | 1487 | 9 | 2230 |
| 14 | 3 | 0703 | 6 | 1406 | 9 | 2108 |
| 15 | 3 | 0659 | 6 | 1318 | 9 | 1977 |
| 16 | 3 | 0613 | 6 | 1225 | 9 | 1838 |
| 17 | 3 | 0563 | 6 | 1126 | 9 | 1688 |
| 18 | 3 | 0512 | 6 | 1023 | 9 | 1535 |
| 19 | 3 | 0455 | 6 | 0910 | 9 | 1365 |
| 20 | 3 | 0397 | 6 | 0793 | 9 | 1190 |
| 21 | 3 | 0336 | 6 | 0672 | 9 | 1007 |
| 22 | 3 | 0272 | 6 | 0554 | 9 | 0815 |
| 23 | 3 | 0205 | 6 | 0410 | 9 | 0615 |
| 24 | 3 | 0136 | 6 | 0272 | 9 | 0408 |
| 25 | 3 | 0063 | 6 | 0126 | 9 | 0189 |
| 26 | 2 | 2988 | 5 | 2976 | 8 | 2964 |
| 27 | 2 | 2910 | 5 | 2820 | 8 | 2730 |
| 28 | 2 | 2829 | 5 | 2659 | 8 | 2488 |
| 29 | 2 | 2746 | 5 | 2492 | 8 | 2238 |
| 30 | 2 | 2660 | 5 | 2320 | 8 | 1980 |
| 31 | 2 | 2571 | 5 | 2142 | 8 | 1715 |
| 32 | 2 | 2481 | 5 | 1961 | 8 | 1442 |
| 33 | 2 | 2387 | 5 | 1774 | 8 | 1160 |
| 34 | 2 | 2290 | 5 | 1581 | 8 | 0871 |
| 35 | 2 | 2190 | 5 | 1383 | 8 | 0574 |
| 36 | 2 | 2090 | 5 | 1180 | 8 | 0270 |
| 37 | 2 | 1987 | 5 | 0993 | 7 | 2960 |
| 38 | 2 | 1880 | 5 | 0760 | 7 | 2640 |
| 39 | 2 | 1772 | 5 | 0543 | 7 | 2315 |
| 40 | 2 | 1660 | 5 | 0320 | 1 | 7980 |
| 41 | 2 | 1547 | 5 | 0094 | 7 | 1641 |
| 42 | 2 | 1431 | 4 | 2863 | 7 | 1294 |
| 43 | 2 | 1314 | 4 | 2627 | 7 | 0940 |
| 44 | 2 | 1194 | 4 | 2239 | 7 | 0583 |
| 45 | 2 | 1071 | 4 | 2142 | 7 | 0213 |
| 46 | 2 | 0947 | 4 | 1893 | 6 | 2840 |
| 47 | 2 | 0820 | 4 | 1640 | 6 | 2460 |
| 48 | 2 | 0691 | 4 | 1383 | 6 | 2074 |
| 49 | 2 | 0560 | 4 | 1121 | 6 | 1682 |
| 50 | 2 | 0428 | 4 | 0855 | 6 | 1283 |
| 51 | 2 | 0293 | 4 | 0586 | 6 | 0879 |
| 52 | 2 | 0157 | 4 | 0313 | 6 | 0470 |
| 53 | 2 | 0018 | 4 | 0036 | 6 | 0054 |
| 54 | 1 | 2878 | 3 | 2755 | 5 | 2633 |
| 55 | 1 | 2736 | 3 | 2471 | 5 | 2207 |
| 56 | 1 | 2592 | 3 | 2184 | 5 | 1775 |
| 57 | 1 | 2446 | 3 | 1893 | 5 | 1339 |
| 58 | 1 | 2299 | 3 | 1301 | 5 | 0451 |
| 59 | 1 | 2150 | 3 | 1301 | 5 | 0451 |
| 60 | 1 | 2000 | 3 | 1000 | 5 | 0000 |

| | | | | | | |
|----|---|------|---|------|---|------|
| 61 | 1 | 1849 | 3 | 0698 | 4 | 2547 |
| 62 | 1 | 1695 | 3 | 0389 | 4 | 2084 |
| 63 | 1 | 1540 | 3 | 0080 | 4 | 1619 |
| 64 | 1 | 1384 | 2 | 2767 | 4 | 1151 |
| 65 | 1 | 1226 | 2 | 2452 | 4 | 0679 |
| 66 | 1 | 1067 | 2 | 2135 | 4 | 0202 |
| 67 | 1 | 0907 | 2 | 1813 | 3 | 2721 |
| 68 | 1 | 0746 | 2 | 1492 | 3 | 2238 |
| 69 | 1 | 0584 | 2 | 1167 | 3 | 1751 |
| 70 | 1 | 0420 | 2 | 0840 | 3 | 1260 |
| 71 | 1 | 0257 | 2 | 0513 | 3 | 0770 |
| 72 | 1 | 0090 | 2 | 0181 | 3 | 0271 |
| 73 | 0 | 2924 | 1 | 2848 | 2 | 2772 |
| 74 | 0 | 2757 | 1 | 2513 | 2 | 2270 |
| 75 | 0 | 2588 | 1 | 2176 | 2 | 1765 |
| 76 | 0 | 2419 | 1 | 1838 | 2 | 1258 |
| 77 | 0 | 2249 | 1 | 1499 | 2 | 0748 |
| 78 | 0 | 2079 | 1 | 1158 | 2 | 0237 |
| 79 | 0 | 1908 | 1 | 0816 | 1 | 2723 |
| 80 | 0 | 1737 | 1 | 0473 | 1 | 2210 |

TABLE OF REDUCTION.

Of the Minutes of each Parallel into Leagues and geometrical Paces.

| | 13 | 1000 | 16 | 2000 | 20 | 0000 |
|----|----|------|----|------|----|------|
| 0 | 13 | 1000 | 16 | 2000 | 20 | 0000 |
| 1 | 13 | 0994 | 16 | 1992 | 19 | 2991 |
| 2 | 13 | 0975 | 16 | 1968 | 19 | 2962 |
| 3 | 13 | 0957 | 16 | 1947 | 19 | 2918 |
| 4 | 13 | 0903 | 16 | 1878 | 19 | 2854 |
| 5 | 13 | 0851 | 16 | 1813 | 19 | 2770 |
| 6 | 13 | 0781 | 16 | 1726 | 19 | 2671 |
| 7 | 13 | 0702 | 16 | 1628 | 19 | 2553 |
| 8 | 13 | 0611 | 16 | 1513 | 19 | 2416 |
| 9 | 13 | 0507 | 16 | 1383 | 19 | 2260 |
| 10 | 13 | 0397 | 16 | 1246 | 19 | 0295 |
| 11 | 13 | 0265 | 16 | 1082 | 19 | 1898 |
| 12 | 13 | 0125 | 16 | 0907 | 19 | 1888 |
| 13 | 12 | 2974 | 16 | 0717 | 19 | 1461 |
| 14 | 12 | 2811 | 16 | 0514 | 19 | 1217 |
| 15 | 12 | 2637 | 16 | 0296 | 19 | 0955 |
| 16 | 12 | 2451 | 16 | 0063 | 19 | 0676 |
| 17 | 12 | 2251 | 15 | 2814 | 19 | 0377 |
| 18 | 12 | 2047 | 15 | 2559 | 19 | 0071 |
| 19 | 12 | 1820 | 15 | 2275 | 18 | 2730 |
| 20 | 12 | 1587 | 15 | 1983 | 18 | 2380 |
| 21 | 12 | 1343 | 15 | 1678 | 18 | 2014 |
| 22 | 12 | 1087 | 15 | 1359 | 18 | 6631 |
| 23 | 12 | 0821 | 15 | 1026 | 18 | 1231 |
| 24 | 12 | 0544 | 15 | 0680 | 18 | 0816 |
| 25 | 12 | 0252 | 15 | 0315 | 18 | 0378 |
| 26 | 11 | 2952 | 14 | 2940 | 17 | 2928 |
| 27 | 11 | 2640 | 14 | 2550 | 17 | 2460 |
| 28 | 11 | 2317 | 14 | 2177 | 17 | 1976 |
| 29 | 11 | 1984 | 14 | 1730 | 17 | 1476 |
| 30 | 11 | 1641 | 14 | 1301 | 17 | 0961 |
| 31 | 11 | 1285 | 14 | 0857 | 17 | 0429 |
| 32 | 11 | 0922 | 14 | 0403 | 16 | 2883 |
| 33 | 11 | 0547 | 13 | 2933 | 16 | 2320 |
| 34 | 11 | 0161 | 13 | 2452 | 16 | 1743 |
| 35 | 10 | 2765 | 13 | 1957 | 16 | 1148 |
| 36 | 10 | 2360 | 13 | 1450 | 16 | 0540 |
| 37 | 10 | 1946 | 13 | 0933 | 15 | 2919 |
| 38 | 10 | 1520 | 13 | 0400 | 15 | 2280 |
| 39 | 10 | 1086 | 12 | 2858 | 15 | 1629 |
| 40 | 10 | 0640 | 12 | 2300 | 15 | 0959 |
| 41 | 10 | 0188 | 12 | 1735 | 15 | 0282 |
| 42 | 9 | 2726 | 12 | 1157 | 14 | 2589 |
| 43 | 9 | 2254 | 12 | 0567 | 14 | 1881 |
| 44 | 9 | 1778 | 11 | 2973 | 14 | 1167 |
| 45 | 9 | 1285 | 11 | 2356 | 14 | 0427 |

10 Mi.

| | 10 Minutes. | | 20 Minutes. | | 30 Minutes. | |
|------------|-----------------------|-------------------|-----------------------|-------------------|-----------------------|-------------------|
| Parallels. | Leagues of 3000 Paces | geometrical Paces | Leagues of 3000 Paces | geometrical Paces | Leagues of 3000 Paces | geometrical Paces |
| 46 | 9 | 0787 | 11 | 1733 | 13 | 2680 |
| 47 | 9 | 0280 | 11 | 1100 | 13 | 1920 |
| 48 | 8 | 2765 | 11 | 0457 | 13 | 1148 |
| 49 | 8 | 2242 | 10 | 2803 | 13 | 0363 |
| 50 | 8 | 1711 | 10 | 2139 | 12 | 2567 |
| 51 | 8 | 1173 | 10 | 1466 | 12 | 1759 |
| 52 | 8 | 0626 | 10 | 0783 | 12 | 0939 |
| 53 | 8 | 0073 | 10 | 0091 | 12 | 0109 |
| 54 | 7 | 2511 | 9 | 2389 | 11 | 2267 |
| 55 | 7 | 1943 | 9 | 1678 | 11 | 1414 |
| 56 | 7 | 1367 | 9 | 0959 | 11 | 0551 |
| 57 | 7 | 0785 | 9 | 0232 | 10 | 2678 |
| 58 | 7 | 0197 | 8 | 2497 | 10 | 1796 |
| 59 | 6 | 2601 | 8 | 1752 | 10 | 0902 |
| 60 | 6 | 2000 | 8 | 1000 | 10 | 0000 |
| 61 | 6 | 1397 | 8 | 0246 | 9 | 2095 |
| 62 | 6 | 0779 | 7 | 2473 | 9 | 1168 |
| 63 | 6 | 0159 | 7 | 1699 | 9 | 0239 |
| 64 | 5 | 2535 | 7 | 0918 | 8 | 2302 |
| 65 | 5 | 1905 | 7 | 0131 | 8 | 1357 |
| 66 | 5 | 1269 | 6 | 2337 | 8 | 0404 |
| 67 | 5 | 0628 | 6 | 1535 | 7 | 2442 |
| 68 | 4 | 2983 | 6 | 0729 | 7 | 1475 |
| 69 | 4 | 2335 | 5 | 2918 | 7 | 0502 |
| 70 | 4 | 1681 | 5 | 2101 | 6 | 2521 |
| 71 | 4 | 1027 | 5 | 1283 | 6 | 1540 |
| 72 | 4 | 0362 | 5 | 0452 | 6 | 0543 |
| 73 | 3 | 2696 | 4 | 2620 | 5 | 2544 |
| 74 | 3 | 2027 | 4 | 1783 | 5 | 1540 |
| 75 | 3 | 1353 | 4 | 0941 | 5 | 0529 |
| 76 | 3 | 0677 | 4 | 0096 | 4 | 2515 |
| 77 | 2 | 2998 | 3 | 2247 | 4 | 1497 |
| 78 | 2 | 2316 | 3 | 1396 | 3 | 2447 |
| 79 | 2 | 1631 | 3 | 0539 | 3 | 2447 |
| 80 | 2 | 0947 | 2 | 2683 | 3 | 1420 |

The next Instrument, in Order, of those we have embarked for our Voyage, is the *Azimuth Compass*, which differs from the *Common Compass* in this, that there is fastened on the round Box wherein the Card is, a broad Circle, one half whereof is divided into 90 Degrees; and those subdivided diagonally into Minutes. The Index has a Sight moving on a Hinge. From the upper Part of the Sight, to the Middle of the Index, is fastened a fine hypotenusal Lute-string, to give a Shadow on a Line in the Middle of the Index. The Circle is crossed at right Angles with two Threads, from the Extremities whereof are drawn four Lines on the Inside of the round Box: There are also four Lines drawn at right Angles to each other on the Card. The round Box fitted with its Card, graduated Circle, and Index, is hung in Brass Hoops, and those Hoops fastened to a square Box.

The Use of the *Azimuth Compass*, is for finding the Scale, magnetical Azimuth, or Amplitude; and thence the Variation of the Compass.

If the Observation be for an Amplitude at Sun-rising, or an *Azimuth* before Noon; apply the Center of the Index on the West Point of the Card, within the Box; so that the four Lines on the Edge of the Card, and those on the Inside of the Box may meet. If the Observation be for the Sun's Amplitude setting, or an *Azimuth* in the Afternoon, turn the Center of the Index right against the East Point of the Card, and make the Lines within the Box concur with those on the Card: The Instrument thus fitted for Observation, turn the Index towards the Sun, till the Shadow of the Thread falls directly on the Slit of the Sight, and on the Line that is along the Middle of the Index; then will the inner Edge of the Index cut the Degree and Minute of the Sun's magnetical *Azimuth* from the North or South.

But note, that if, when the Compass is thus placed,

the *Azimuth* is less than 45 Degrees from the South, and the Index turned towards the Sun, it will pass off the Divisions of the Limb: The Instrument, therefore, in this Case, must be turned just a Quarter of the Compass, *i. e.* the Center of the Index must be placed on the North or South Point of the Card, according as the Sun is from you; and then the Edge will cut the Degree of the magnetical *Azimuth*, or Sun's *Azimuth* from the North as before.

The Sun's magnetical Amplitude thus found, the Variation of the Needle is thus determined.

Being out at Sea the 15th of May, 1744, in 45° North Latitude, the Tables give you the Sun's Latitude 19° North, and its East Amplitude 27° 25' North: By the *Azimuth Compass*, we find the Sun's magnetical Amplitude, at its Rising and Setting; and finds he rises, *v. gr.* between the 62d and 63d Degree, reckoning from the North towards the East Point of the Compass, *i. e.* between the 27th and 28th Deg. reckoning from the East.

The magnetical Amplitude, therefore, being here equal to the true one, the Needle has no Variation: But if the Sun at its Rising should have appeared between 52d and 53d Degree, from the North towards the East; his magnetical Amplitude would then have been between 37 and 38 Degrees, *i. e.* about 10 Degrees greater than the true Amplitude: Therefore the Needle would vary about 10 Degrees North Easterly.

If the magnetical East Amplitude found by the Instrument, should be less than the true Amplitude, their Difference would shew the Variation of the Needle Easterly.

If the true East Amplitude be Southward, as also the magnetical Amplitude, and this last be the greater; the Variation of the Needle will be North-West; and *vice versa*.

What has been said of North-East Amplitudes, holds also of South-West Amplitudes. And what of South-East Amplitudes, holds of North-West Amplitudes.

Lastly, if Amplitudes be found of different Denominations, *v. gr.* if the true Amplitude be 6 Degrees North, and the magnetical Amplitude 5 Degrees South; the Variation, which in this Case is North-West, will be equal to the Sum of the magnetical and true Amplitudes: Understand the same for West Amplitudes.

The Variation may likewise be found from the *Azimuth*: But in that Case, the Sun's Declination, Latitude of the Place, and its Altitude must be given, that its true *Azimuth* may be found.

Note, That *Azimuth* of the Sun, or a Star (as observed in my Treatise of *Astronomy*) is an Arch of the Horizon, comprehended between the Meridian of the Place, and any given Vertical. The *Azimuth* is the Complement of the Eastern and Western Amplitude to a Quadrant. *Magnetical Azimuth*, is an Arch of the Horizon contained between the Sun's *Azimuth* Circle, and the magnetical Meridian; or it is the apparent Distance of the Sun, from the North or South Point of the Compass.

Note also, That *Amplitude* is an Arch of the Horizon, intercepted between the true East or West Point thereof, and the Center of the Sun, or a Star, at its Rising or Setting. Amplitude is of two Kinds, *Eastern* or *Rising Amplitude*, *Amplitudo occidaria*, is the Distance between the Point wherein the Star sets, and the true Point of the West in the Equinoctial. The *Eastern* and *Western Amplitudes*, are also called *Northern* and *Southern*, as they fall in the Northern or Southern Quarters of the Horizon. *Magnetical Amplitude* is an Arch of the Horizon, contained between the Sun at its Rising, and the East or West Point of the Compass, or it is the Difference of the Rising or Setting of the Sun, from the East or West Point of the Compass.

The *Equinoctial Compass*, which we have, likewise, among our Instruments, serves to know at what Point the Moon. That Compass being risen on the Superficy of the Equinoctial Line, divides it justly into equal Parts, as the common Compass does the Horizon. We see the Line which runs through the Figure of that Compass, represents the Axis of the World. The Round before the Compass must be marked on both Sides, as well

well upwards and downwards. Inside with a common Compass, and on the Outside with twice twelve Hours; and on both Sides, which mark the East and West, it must be suspended on the Tops of two Pegs, as an Axletree, so that it may turn upwards, and that the lower Part of the Arrow, which is on the Quadrant, may be placed on all the Altitudes of the Pole.

The *nocturnal Compass*, is a very common Instrument, used to find at all Hours of the Night, how much the northern Star is higher or lower than the Pole. It is also called a *Quadrant for the Stars*, because it shews the Hours in the Night by means of the Stars. Mariners make use most commonly for that Purpose, of the Stars of *Urfa Major*, in this Hemisphere, because they are more remarkable than the others which are nearer the northern Pole; but in the other Hemisphere, or beyond the Line, they chuse the *Crusade*, which is a Constellation composed of four Stars, which are easily distinguished.

As the *Sector*, or *Compass of Proportion*, is also of very great Use in Navigation, we must not fail without it; therefore,

The *Sector*, is a mathematical Instrument, of great Use in finding the Proportion between Quantities of the same Kind, as between Lines and Lines, Surfaces and Surfaces, &c.

The great Advantage of the *Sector* above the common Scales, &c. is, that it is made so as to fit all Radius's and Scales. By the Lines of Chords, Sines, &c. on the *Sector*, we have Lines of Chords, Sines, &c. to any Radius betwixt the Length and Breadth of the *Sector* when opened.

The *Sector* is founded on the fourth Proposition of the sixth Book of *Euclid*, where it is demonstrated, that similar Triangles have their homologous Sides proportional.

This Instrument consists of two equal Rules, or Legs of Brass, or other Matter, riveted together; but so as to move easy on the Rivet. In the Faces of the Instrument are placed several Lines; the Principal are the Line of equal Parts, Line of Chords, Line of Sines, Line of Tangents, Line of Secants, and Line of Polygons.

The *Line of equal Parts*, called also *Lines of Lines*, marked 6, is a Line divided into 100 equal Parts; and where the Length of the Line will allow it, each is subdivided into Halves, and Quarters. It is founded on each Leg, on the same Side; and the Divisions numbered 1, 2, 3, 4, &c. to 10, which is near the Extremity of each Line. In Practice 1 is taken for 10, or 100, or 1000, or 10,000, &c. as Occasion requires; in which Cases 2 represents 20, or 200, or 2000, &c. and so of the rest.

The *Line of Chords*, marked C on each Leg, is divided after the usual Manner, and numbered 10, 20, 30, &c. to 60.

The *Line of Sines*, denoted on each Leg by the Letter S, is a Line of natural Sines, Numbered 10, 20, 30, &c. to 90.

The *Line of Tangents*, denoted on each Leg by the Letter T, is a Line of natural Tangents, numbered 10, 20, 30, &c. to 45; besides which is another little Line of Tangents on each Leg, commencing at 45°, and extending to 75°, denoted by the Letter T.

The *Line of Secants*, denoted on each Leg by the Letter S, is a Line of natural Secants, numbered 10, 20, 30, &c. to 75, and commencing, not from the Center of the Instrument, but at two Inches Distance therefrom.

The *Line of Polygons*, denoted by the Letter P, on each Leg is numbered 4, 5, 6, &c. to 12, which falls 12 Inches short of the Center of the Instrument.

Beside these Lines, which are essential to the *Sector*, there are others placed near the outward Edges on both Faces, and parallel, which are in all Respects the same as in *Gunter's Scale*, and used after the same Manner. Such are the Lines of artificial Sines, marked S; the Line of artificial Tangents, a Line of 12 Inches, marked M, and *Gunter's* Line of Numbers marked N. There are sometimes other Lines placed to fill up the vacant Spaces, as the Lines of Hours, Latitudes, and Inclinations of Meridians, which are used the same as on the common Scales.

Our STAFFS, will be the *Jacob-Staff*, or *Fore-Staff*, and *Back-Staff*.

JACOB-STAFF, the same with *Cross-Staff*, is a mathematical Instrument for taking Heights and Distances.

The *Jacob*, *Cross*, or *Fore-Staff*, takes its Denomination hence, that the Observer in using it, turns his Face towards the Object; in Contradiction to *Back-Staff*, where he turns his Back to the Object. The *Fore* or *Cross-Staff*, represented in our Table of the Magnet, consists of a straight, square, graduated Staff, and four Crosses or Vanes, which slide thereon. The first, or shortest of these Vanes, is called the *Ten-Cross*, or *Vane*, and belongs to that Side of the Instrument, whereon the Divisions begin at 3 Degrees, and end at 10. The next longer Vane is called the *Thirty-Cross*, belonging to that Side of the Staff, wherein the Divisions begin at 10 Degrees, and end at 30, called the *thirty Scale*. The next Vane is called the *Sixty-Cross*, and belongs to the Side where the Divisions begin at 20 Degrees, and end at 60. The last, and longest, called the *Ninety-Cross*, belongs to the Side whereon the Divisions begin at 30 Degrees, and end at 90.

The great Use of this Instrument is to take the Height of the Sun and Stars, or the Distance of two Stars; and the ten, thirty, sixty, or ninety Crosses, are to be used according as the Altitude is greater or lesser, that is, if the Altitude be less than 10 Degrees, the tenth Cross is to be used; if above ten, but lesser than thirty, the thirtieth Cross to be used, &c.

Note, That for Altitudes greater than 60 Degrees, this Instrument is not so convenient as a Quadrant, or Semicircle.

To observe an Altitude by the *Fore-Staff*, apply the flat End of the Staff to your Eye, and look at the upper End of the Cross of the Center of the Sun or Star, and at the lower End for the Horizon. If you see the Sky instead of the Horizon, slide the Cross a little nearer the Eye; and if you see the Sea instead of the Horizon, slide the Cross further from the Eye: And thus continue moving, till you see exactly the Sun or Star's Center, by the Top of the Cross, and the Horizon by the Bottom thereof.

Then the Degrees and Minutes cut by the inner Edge of the Cross upon the Side of the Staff, peculiar to the Cross you use, is the Altitude of the Sun or Star.

If it be the meridian Altitude you want, continue your Observation as long as you find the Altitude increase, still moving the Cross nearer to the Eye.

By subtracting the meridian Altitude thus found, from 90 Degrees you will have the Zenith Distance.

To work accurately, an Allowance must be made for the Height of the Eye, above the Surface of the Sea, viz. for 1 English Foot, 1 Minute, for 5 Feet 2½, for 10 Feet 3½, for 20 Feet 5, for 40 Feet 7, &c.

These Minutes subtracted from the Altitude observed, and added to the Zenith Distance observed, give the true Altitude, and Zenith Distance.

To observe the Distance of two Stars, or the Moon's Distance from a Star, by the *Fore-Staff*. Apply the Instrument to the Eye, and looking to both Ends of the Cross move it nearer, or farther from the Eye, till you see the two Stars; the one on one End, and the other on the other End of the Cross. Then the Degrees and Minutes cut by the Cross on the Side proper to the Vane in use give the Star's Distance.

The *Back-Staff*, is an Instrument, by the French called the *English Quadrant*, invented by Captain Davis, of good Use in taking the Sun's Altitude at Sea. It consists of three Vanes, and of two Arches, viz. the *Horizon Vane*, the *Shade Vane*, and the *Sight Vane*.

To use this Staff, the *Shade Vane* is fit upon the Arch, to an even Degree of some Altitude, less by 10, or 15 Degrees than you judge the Complement of the Sun's Altitude will be; and the *Sight Vane* on the thirtieth Arch: The Observer's Back being then turned to the Sun (whence the Name of *Back-Staff*, or *Back-Quadrant*) he lifts up the Instrument, and looks through the *Sight Vane*, raising or falling the Quadrant, till the Shadow of the upper Edge of the *Shade Vane*, fall on the upper Edge of the Slit in the *Horizon Vane*; and then

then if you can see the Horizon through the said Slit, the Observation is well made; but if the Sea appears instead of the Horizon, move the Sight-Vane: If the Sky appears move it upwards, and so try if it comes right; then observe how many Degrees and Minutes are cut by that Edge of the Sight-Vane, which answers to the Sight-Hole, and to them add the Degrees cut by the upper Edge of the Shade-Vane; the Sum is the Sun's Distance from the Zenith, or the Complement of his Altitude. To find the Sun's Meridian, or greatest Altitude on any Day, continue the Observation as long as the Altitude is found to increase, which you will perceive by the Appearance of the Sea instead of the Horizon, removing the Sight-Vane lower; but when you perceive the Sky appear instead of the Horizon, the Altitude is diminished; therefore desist from further Observation at that Time, and add the Degrees upon the sixtieth Arch to the Degrees and Minutes upon the thirtieth Arch, and the Sum is the Zenith Distance, or Co-altitude of the Sun's upper Limb.

And because it is the Zenith's Distance, or Co-altitude of the upper Limb of the Sun, not the Center that is given by the Quadrant, in observing by the upper End of the Shade-Vane, add 16 Minutes, the Sun's Semidiameter, to that which is produced by your Observation, and the Sum is the true Zenith Distance of the Sun's Center. If you observe by the lower Part of the Shadow of the Shade-Vane, then the lower Limb of the Sun gives the Shadow; and therefore you must subtract 16 Minutes from what the Instrument gives; but considering the Height of the Observer above the Surface of the Sea, which is commonly between 16 and 20 Feet, you may take 5 or 6 Minutes from the 16 Minutes, and make the Allowance but of 10 or 12 Minutes to be added instead of 16 Minutes.

M. Flamsteed contrived a Glass Lens, or double Convex, to be placed in the Middle of the Shade-Vane, which makes a small bright Spot on the Slit of the Horizon-Vane, instead of the Shade; which is a great Improvement, if the Glass be truly made; for by this Means the Instrument may be used in hazy Weather, and a much more accurate Observation made in clear Weather, than could be by the Shadow.

From this I'll pass to examine our *Log-Line*, which is a little Cord or Line fastened to one End of the *Log*, and wound round a Reel, fixed for that Purpose in the Gallery of the Ship.

Note, That a *Log* is a small Piece of Timber of a triangular Figure on board a Ship; into one End whereof a convenient Quantity of Lead is cast, to make it swim upright in the Water; the other End being fastened to a Line.

This Line from the Distance of about ten Fathom off the *Log*, has certain Knots or Divisions, which ought to be at least 50 Feet from each other; though it is the common Practice at Sea not to have them above 42 Feet asunder.

The Use of the *Log* and *Line*, is to keep Account, and make an Estimate of the Ship's Way, or Distance run, which is done by observing the Length of the Line unwound in half a Minute's Time, told by a half-minute Glass; for so many Knots as run out in that Time, so many Miles the Ship sails in an Hour.

Thus, if there be four Knots veered out in half a Minute, the Ship is computed to run four Miles an Hour.

To heave the *Log*, as they call it, they throw it into the Water, letting it run till it comes without the Eddy of the Ship's Waste, then one holding a half-minute Glass, turns it up just as the first Knot turns off the Reel (though some turn the Glass as soon as the *Log* touches the Water) as soon as the Glass is out the Reel is stopped, and the Knots run off are told, and their Pairs estimated.

The *Log* ought to be heaved every Hour, or every two Hours, though in *French* Vessels we heave but every three Hours.

The *Log* is a very precarious Way of computing, and must always be corrected by Experience and good Sense, there being a great deal of Uncertainty, both in the heaving of it, in the Course of the Currents, and in the Strength of the Wind, which seldom keeps the same

Tenor for two Hours together; which is the Interval between the Times of using the *Log* in short Voyages, though in long ones they have it every Hour. Yet some are of Opinion, that this is a much more exact Way of computing than any other in Use; much preferable certainly to that of the *Spaniards* and *Portuguese*, who guess at the Ship's Way by the running of the Froth or Water by the Ship's Side; or to that of the *Dutch*, who us'd to heave a Chip overboard, and to number the Paces they walk on the Deck, while the Chip swims between any two Marks or Bulk-head on the Side.

There is also the *Log-board*, which is a Table divided into four or five Columns, whereon are marked the Reckoning of every Day; from whence they are entered into the *Log-Book*, or *Traverse-Book*, ruled and columned just as the *Log-board* is: Whence it may be transcribed into the Journals, and how much the Ship gains in her Course be estimated daily.

In the first Column of the *Log-board* is entered the Hour of the Day, from One to One: In the second, the Rhumb, or the Direction of the Vessel, with regard to the Points of the Compass: In the third, the Number of Knots run off the Reel each Time of heaving the *Log*: In the fourth, the Wind that blows; and in the fifth, Observations made of the Weather, Variation of the Compass, &c.

We'll also take Care to provide ourselves with *Hour-Glasses*, which are a Kind of Chronometer, or *Clepsydra*, serving to measure the Flux of Time, by the descent or running of Sand, out of one Glass Vial into another.

The best *Hour-Glasses* are those, which instead of Sand, have Egg-shells well dried in the Oven, then beaten fine and sifted.

Having thus fitted ourselves with all the Instruments necessary for our Navigation, we'll take Care next to load the Ship we are to sail in, which can be done different Ways: For it is certain, that a Ship loaded very *apropos*, will sail much better than if the Loading was ill ordered; and there are Ships which being more loaded towards the Prow than towards the Poop, sail much better; and others on the contrary, which ought to be more loaded towards the Poop than towards the Prow. Some want to be much loaded, others only a middle Loading; which must be left entirely to the Experience of a good Pilot.

Archimedes, and after him *Simon Stevin*, say, that the Burthen of a Ship is equal to the Weight of the Mass of Water, whose Place it occupies. The Weight of the Mass of Water can be discovered by finding how many cubick Feet contains that Part of the Ship which enters the Water, *i. e.* from the Bottom of the Carène to the lower Deck, because one can know the Weight of a cubick Foot of Water; but the Difficulty is to know how much the Ship with all its Tacklings weighs.

The Practice discovers the Burthen of a Ship, by its Cavity Inside, and it is determined by multiplying the Length of the Keel taken within board, from the Midship Beam from Plank to Plank, and the Product by the Depth of the Hold, taken from the Plank below the Keelson, to the under Part of the upper Deck Plank, and dividing the last Product by 94, and the Contents is the Quotient of the Tonage required.

For Example, a Ship which has 76 Feet in Keel, 27 of Breadth, and 10 of Depth, will be capable to carry 300 Tons, which is 600,000 Pounds weight.

It is believed, that a Ship with all her Men, Cannons, Cordages, Sails, Masts, can weigh as much as she can carry, *i. e.* that a Ship of 300 Tons weighs herself above 600,000 Pounds.

The first Thing put in the Hold of a Ship is the *BALLAST*, which is any heavy Matter used to sink a Vessel to its proper Depth in Water, or to give it a just Weight and Counterpoise, and enable it to bear Sail without overturning.

The ordinary *Ballast* is Sand, or Stones stowed in the Bottom or Hold, next the false Keel of a Vessel; sometimes Lead, Corn, or other heavy Goods serve for *Ballast*. The *Ballast* is sometimes one Half, sometimes a third, and sometimes a fourth Part of the Burthen of the Vessel. Flat Vessels require the most *Ballast*.

Ships are said to be in Ballast, when they have no other Loading.

Masters of Vessels are obliged to declare the Quantity of Ballast they bear, and to unload it at certain Places. They are prohibited unloading their Ballast in Havens, Roads, &c. the Neglect of which has ruin'd many excellent Ports.

Men of War have no other Burthen than their Ballast, Munitions and Provisions; and as ours is supposed such a one, now we have took all those Things on Board, we'll unfurl our Fore-Top Sail, fire a Cannon to call our strolling Sailors on Board, in order to sail for our intended Voyage.

Now all our Men are on Board, and the Tide and Wind serve, we'll work to heave up our Anchors; at present our Anchors are hoisted up; we'll prepare our sounding Line, because we suppose to sail from the Thames, the Entrance whereof is full of Banks of Sand. Now we'll furl up the Sprit-Sail, which we had unfurled to help us to heave up the Anchors, hoist up the Fore-Top Sail, and unfurl the Fore-Sail; Starboard to the Steerer; Starboard again; thus, thus, come no nearer. Now up to the Main Scuttle, to unfurl the Main-Top Sail.

As we suppose to have by this Time clear'd the Land, and to have enough Sea-Room; that we sail with a good Quarter-Wind, we'll begin our Journal, which is a Register kept by the Pilot, wherein Notice is taken of every Thing that happens to the Ship from Day to Day, and from Hour to Hour, with Regard to the Wind, the Rhumbs, the Rake, Soundings, &c. in order to enable him to adjust the Reckoning, and determine the Place where the Ship is: Thus,

JOURNAL of 12 Hours.

| Rhumb. | Value of the Rhumb. | Wind. | Quality of the Wind. | Leagues of 3000 Paces. |
|--------|---------------------|-------------------|----------------------|------------------------|
| W.N.W. | W.N.W. | E. S. E. back | middling | 2 |
| W.N.W. | W.N.W. | E. S. E. back | good or fresh. | 3 |
| W.N.W. | W.N.W. | E. S. E. back | middling | 2 |
| W.N.W. | W.N.W. | S. E. sidewise | good | 4 |
| W.N.W. | W.N.W. | S. E. sidewise | middling | 1½ |
| N.W. | W.N.W. | S. E. sidewise | little Wind | 2 |
| N.W. | W.N.W. | S. E. sidewise | middling | 1½ |
| N.N.W. | N.W. | E. S. E. Quarter. | good | 8 |

From the First Day of March at Noon.

| Hour Glasses of half Hour. | Latit. valued. D. M. | Lat. observ'd. D. M. | Longitude. D. M. | Declension of the Needle. D. M. |
|----------------------------|----------------------|----------------------|------------------|---------------------------------|
| 2 | | 41. | 5. | 2. East 30. |
| 2 | | | | |
| 2 | | | | |
| 4 | | | | |
| 2 | | | | |
| 4 | | | | |
| 2 | | | | |
| 6 12 at Night. | 41. 50. | 41. 30. | 3. 15. | 1. 10. |

Journal, 1744.

Note, That in this Journal we suppose to have conveyed some Merchant-Ships to Lisbon, whence we proceed on our Voyage to Jamaica.

IN THE NAME OF GOD, Amen.

The 27th of February, at Noon, the Wind being North-North-East, we sailed from the Gulph of Lisbon, to proceed, with God's Assistance, on our Voyage to Jamaica, in his Majesty's Ship the N. 400 Tons Burthen, carrying 36 Guns; the Captain M. P. the Lieutenant M. R. and the first Pilot N. God grant us a good Voyage.

We anchored by about 12 Fathoms of Water, and after we had waited till the 18th, we heaved up our Anchor at Six in the Morning, with a middling easterly Wind; and after we had doubled the Cape of Rocca, we put the Cape to the North-West till Six in the Evening; but that Rhumb was worth but West-North-West to us, because of the Currents, and we reckoned to have made 25 Leagues.

About Six in the Evening, the Wind being turned to the South, we kept still the Cape to the North-West, therefore that same Wind having lasted till Twelve at Noon the next Day, we reckon'd to have sailed 55 Leagues by that Rhumb. For having made our Observation, we found ourselves at 40 Degrees of Latitude, and by Estimate at 5 of Longitude.

| Rhumb. | Value of the Rhumb. | Wind. |
|--------|---------------------|----------|
| N. W. | W. N. W. | E. Mid. |
| N. W. | N. W. | S. Good. |

| Leagues. | Latitude. | Longitude. |
|----------|-----------------|----------------|
| 25 | 38 Deg. 30 Min. | 9 Deg. 15 Min. |
| 55 | 41 Deg. 0 Min. | 5 Deg. 0 Min. |

From Twelve at Noon, of the 1st Day of March, we sailed on the North-West, ¼ West, with a very unsettled Wind, sometimes good, sometimes middling, which blew Part from the East-South-East, and Part from the South-East. We reckoned to have sailed 24 Leagues in 12 Hours, and to be under the 41°, 50', of Latitude. And by that Observation, judged that we were under the 3° 15' of Longitude, and that same Current had made us lie by West-North-West.

The second Day of the same Month, we were overtaken by a violent Tempest, mixed with Thunder and Lightning, and Night happening all on a sudden, a prodigious Puchot (which is a Kind of Whirlwind) seized our Ship by the Bow-sprit with so much Violence, that it laid her on her Side; we then thought ourselves lost; but that Whirlwind finding no Hold on that Side of the Ship, was soon over, and our Ship raised herself by Degrees. We were forced to throw some Pieces of Cannon, and some Merchandizes over-board; because the Tempest continued till the next Day, and was followed by very foul Weather, which continued till the 5th in the Morning; and that Day having made an Observation, at Noon, we found ourselves under the 39° 12'; and having told our Hour-Glasses, for 12 at Noon of the first Day of March, there were but 193, i. e. one more than four times 48, wanted for the four Days, at that Time there could be one Quarter of the Sand run through. We reckoned then, that we could be distant from the Meridian of the Place, where we were the first of March, at Noon, but of about 9 Degrees Westward; because the Sun running thro' 7½ in a half Hour, the Degree and a half above was reckoned for the Quarter of the Sand run at the Time of the Observation; and that, therefore, we could be under the 356 Degrees of Longitude.

By that Reasoning we corrected our Estimate, and judge, in pointing our Chart, that we had made 115 Leagues, and that we were distant from the Tercera Islands, of about 40 Leagues.

| Rhumb. | Value of the Rhumb. | Wind. |
|------------|---------------------|----------------------------|
| N. W. ¼ W. | W. N. W. | E. S. E. middling |
| W. N. W. | W. S. W. | N. N. E. compass. Leagues. |

| <i>Leagues.</i> | <i>Latitude.</i> | <i>Longitude.</i> |
|-----------------|------------------|-------------------|
| 24 | 41° 30' | 3° 15' |
| 115 | 39° 12' | 356° 0' |

6. We were scarce recovered from our Fright, caused by the Tempest, that the 6th of *March* about Eight in the Morning, we discovered four *Spanish* Men of War, which chased us; but as we were not capable to cope with them, we set out all our Sails, and putting the Cap to the North, we bore away for the Isle of *St. Michael*, where we cast Anchor about Five in the Evening under Shelter of the Castle, which we saluted with two Pieces of Cannon; and though it be not a very safe Place, the Enemy did not dare to attack us there.

| <i>Rhumb.</i> | <i>Val of the Rhumb.</i> | <i>Wind</i> |
|-----------------|--------------------------|-------------------|
| S. S.W. | S. S.W. | N. good. |
| <i>Leagues.</i> | <i>Latitude.</i> | <i>Longitude.</i> |
| 22 | 38° 15' | 355° 20' |

7. The Weather was fair enough during the five Days we were forced to remain in the Road of that Island, to refit our Ship by the Governor's Leave, who gave us fresh Provisions. We took our Observation, and found that our Compass declined no longer.

12. The twelfth, at Ten in the Morning we hove up our Anchor by a good Wind of South-East, and sailed towards the Island *Tercera*, which we saluted with two Pieces of Cannon. The next Day early in the Morning we continued our Voyage towards *Jamaica*.

That's the Plan and Order which can be followed in a grand Journal: Some reduce it into a Table of ten or twelve Columns, like that of 24 Hours, but make the Squares four Times bigger, to have more Room for their particular Observations; others fill their Journals with every Thing that passes in the Ship, even the less worthy of Notice, as Words, Disputes, &c. which is a very scandalous Conduct.

From these two Models of a Journal, I'll pass to some necessary Observation on the Winds.

There are certain Winds which are called regular, because they blow in certain particular Countries, and in certain Seasons. For Example, under the torrid Zone there blows almost always an easterly Wind. Therefore when the *Spaniards* sail to *America*, they most commonly go to cast Anchor at the *Canary Islands*, and descend still lower towards the torrid Zone, to take the easterly Wind. They do the same when they sail to *Peru*, towards the *Philippine Islands*; they touch at *Aquapulco* on the Coasts of *New Spain*, to take the good Winds; whence they go to reconnoitre the Isles of *Lazares*, which are in the Archipelago of *St. Lazare*, Eastward of the *Philippines*, where they arrive by the same Wind.

When they want to come back, they must ascend higher than the Isles of *Japan*, about the 40th Degree of Latitude, whence they sail towards the Coasts of *New Mexico*, because finding there most commonly a North-West Wind, they descend towards *California*, whence they return to *Aquapulco*.

When they want to return from *America* into *Spain*, they return from *Porto Bello*, which is on the Isthmus of *Panama*, and go to reconnoitre Cape *St. Antony*, which is the most westward Point of the Island *Cuba*, in the Gulph of *Mexico*; and after they have touched at the *Havana*, which is the most considerable Place of that Island, they pass between the Shallows of *Bimini* and the Point of *Florida*, and through the Straights of *Bahama*, whence ranging the Coast of *Florida*, and after they have discovered Cape *St. Roman* in *Virginia*, they sail still more northward, to take the Height of the *Azores* towards the 40th Degree of Latitude, where finding commonly a favourable Wind, they return into *Spain* without much Difficulty. The *French* follow the same Method, at their Return from the Gulph of *Mexico* into *Europe*.

In the *Indian Sea*, between the *Molucca's* and the *Peninsula*, this *Side* *Ganges*, the easterly Winds blow commonly from *June* to *October*, and the rest of the Year, the westerly Winds are most frequent there.

There are certain regular Winds, which the *Indians* call *Monsons*, as those which blow between *Java* and

China, and are between the South-East and North-East, from the Beginning of *September* to the latter End of *March*; the rest of the Year they are East or South-East. Towards the Streight of *Malacca* a North Wind blows from *November* till *April*, and a South, or South-East Wind, from *May* till *August*.

Towards *New France*, the North Wind commonly begins to blow towards the End of *November*, and lasts till the End of *March*; then the South-West during the Spring and Summer, and sometimes the North-West, but it lasts little.

On the *Mediterranean* an easterly Wind blows commonly from East to South; and from the South a westerly one very often succeeds to it.

But though those Winds are called regular, because Experience shews them often such, we ought not, notwithstanding, to depend entirely on them, since nothing is more inconstant than that Meteor.

As to Winds which may serve to keep the same Course, the Antients have never took any Notice of them, because they imagined that it was impossible to sail on the Sea, without going before the Wind, or at least should be but very little contrary. And we see in History, that *Andrew Doria*, Lieutenant General of the *French* Gallies under the Reign of *Francis I.* was thought a Sorcerer among the Sailors of the Black Sea, when they saw him sail towards their Ship and come to meet them, with an almost contrary Wind.

It is a surprizing Thing, that of 32 Winds or Rhumbs, into which the whole Plan of the Horizon is divided, 20 or 21 of them can serve us to sail towards the same Place; and what is still more surprizing, and almost incredible, is that, that the Wind which is entirely contrary to a Ship, does not hinder it from sailing forwards; it is true that the Course is a little lengthned, because one is obliged to bolt to and again. A westerly Wind makes a Ship advance northward or southward, as well as an easterly one, when it blows between two Sheets; and we see daily, in the Straights, Ships which keep contrary Courses with the same Wind.

Therefore I say, that a Pilot can make use of 21 Winds for the same Course; for Instance, if he wants to sail southwards all the Winds will serve, from the South-East by East to the South-West by West, so that there are not two Rhumbs and half of contrary Winds; since, for Instance, if the Wind be South-East by East, it will be reckoned for its Point, and consequently there will be no more but eleven Points from Board to Board, which is called to bolt to and again on eleven Points.

It seems, that a Wind full backwards be the best and most favourable, to sail much forwards in a few Hours, notwithstanding which Mariners like best a Side or Quarter Wind, *i.e.* that wanting to sail southward, the North-East and North-West Winds are more proper and favourable than a North Wind, tho' the Ship has it full backwards.

The Reason of this is, that of a full backwards Wind, none but the Sails of the Main-Mast can serve, for those of the Mizzen-Mast are furled up; those of the Fore-Mast are then but of very little Use, and the Spentail receives the Wind which escapes under the others. But of a side or quarter Wind all the Sails serve, without obstructing one another, and consequently the Ship sails much more forwards than by any other Wind.

Being convinced by Experience, that one bolts to and again on eleven Points, it will not be difficult to imagine how a Ship can sail forwards towards the Place proposed with a contrary Wind.

Suppose a Pilot to be at Sea, and sailing northwards, should see the Wind to change and blow hard North, then if there be no Tempest, he must not command to bring down the Sails; but putting, for Instance, the Cap to the North-East by East, he shall sail forwards on that Side for a certain Time; then turning the Cap to the North-West, he'll sail forwards likewise, till the Wind changes; thus bolting to and again, he'll continue his Course in lengthening it.

It must be observed, that one can make use thus of a contrary Wind, but in fair Weather; for in a Tempest all the Sails must be struck, and when the Rudder alone is not sufficient to keep up the Ship in her Course, she lies by, *i.e.* that having the Cap to the North-West, and the Wind being North, the Dutt will blow her to

the West-South-West, and make her sail about half a League every Hour, provided there be neither Currents nor Tides; for then she might sail much from her Course.

As to the Forerunners of Wind, Rain, and Tempest at Sea, F. Fournier in his Hydrography relates, that in his Voyage to Canada, the Sailors of the Ship where he was, seeing a white Circle round the Sun, told him, that they should soon have something to do; as in effect it happened soon afterwards; for the Wind began to blow very fresh, and they had such hard Weather all the Night following, that they were forced to furl all their Sails.

He says besides, that when a red Cloud is seen on the Horizon at Sun-rising or setting, one must expect Wind from that Side.

When red Clouds are seen to precede the Sun's Rising, or when its Rays appear of that Colour when it rises, it is a common Sign that it will blow hard.

When the Sun sets, if it be seen environed with a blueish or black Circle, it is a Sign of a Tempest.

If the Sun rising appears pale, it will bring Rain; and if it be of the same Colour at its setting, there will be Wind.

When the Sun appears red at its setting, one must expect that it will blow hard for several Days.

When the Sun covers itself with Clouds at its rising, and shoots its Rays underneath, he'll send Rain; if the Rays come out at the Middle, there will be a Tempest with Rain.

When the Clouds come from all Parts and gather round the Sun, it is a Sign of Tempest.

If the Sun sets covered with a Cloud, it will rain the next Day; and if at its setting it is seen drawing some Clouds after him, it is a Sign of Tempest.

Sailors make still a better Use of the Moon to prognosticate fair or foul Weather. For Instance, they always fear the fifth Day of the Moon, and say, that it is more subject to Tempests than any other.

When it appears in the New Moon, a Spot in its upper Horn, then that is a Sign of Rain.

If the Moon does not appear before the fourth Day, and it blows a southerly Wind, there will be foul Weather during all that Moon.

When the Moon is environed with a whitish Circle, it is a Sign of Rain; and when there are several of those Circles which are broken, and the Body of the Moon appears reddish, there will be a Tempest.

When the Sea appears blackish, it is a Sign of hard Weather; and when there is Scum here and there over the Sea, or some small Bottle rise on the Water, and the Sea swells all on a sudden, one must prepare for a long and hard Tempest.

When Porpoises or other Fishes frisk on the Water, it is a Sign of an approaching Tempest.

When Swallows fly very low, one must expect Wind and Rain.

Note, That from these Observations on Winds and Tempests, I'll pass to those on Currents, the Knowledge whereof is very essential to Navigation.

CURRENTS, with respect to Navigation, may be defined certain progressive Motions of the Water of the Sea in several Places, either quite down to the Bottom, or to a certain determinate Depth, by which a Ship may happen to be carried forward more swiftly, or retarded in her Course, according to the Direction of setting of the Current in, with, or against the Course or Way of the Ship.

The Business of Currents making a considerable Article in Navigation, the Way they set, together with their Strength, is to be carefully observed: This some do by the Ripplings of the Water, and by the driving of the Froth along the Shore, when in sight of it; but the more usual, as well as the more accurate Way, is thus:

They first fix their Boat, by throwing out a triangular Piece of Wood, with a Piece of Lead fastened to it, and to the Stern of the Boat with a Cord, and letting it sink sixty Fathoms, or more; or sometimes by a Kettle tied by the bowl, and sunk as the other.

By either of these Means the Boat is brought to ride as at Anchor; which done, the Log is cast over, the Glass

turned, and as the Log-line veers out, the Drift of the Log set with the Compass.

This shews whether there be any Current or none; and if any, which Way it sets, and at what Rate it drives; observing however, to add something to the Drift for the Boat's Drift; for though she appears to stand still, yet in Reality she is found to move. This Addition Experience has thus determined, if the Line she rides by be sixty Fathoms, a third Part of the Drift to be added, if eighty Fathoms a Fourth, if an hundred a Fifth.

If a Ship sails along the Direction of a Current, it is evident the Velocity of the Current must be added to that of the Vessel: If her Course be directly against the Current, it must be subtracted. If she sails athwart the Current, her Motion will be compounded with that of the Current, i. e. she will proceed in the Diagonal of the two Lines of Direction, and will describe or pass thro' that Diagonal in the same Time wherein she would have described either of the Sides by the separate Forces.

It cannot be determined that all the Currents found at Sea proceed from the same Cause, since they have almost all different Motions. And when we do not perceive any sensible Cause in the apparent Disposition of the Part of the Earth, to account why a Current runs rather on one Side than on another, that searched for in the Bowels of the Earth, and in the Moon, though true perhaps, is not plausible enough to satisfy certain Minds.

Pilots say, that there is a general Current which runs from the Poles as far as to the Torrid Zone, without entering into Particulars with respect to others which run several Ways. Some Philosophers pretend to have found the Cause thereof, and say, that the Sun being always on the Torrid Zone, where there is thrice as much Sea as there is Earth, exalts from it a great Quantity of Vapours, which being pushed far from their Course by the Heat of its Rays, are condensed by the Cold they meet with in the Frigid Zones, where they re-assume their former Figure. Those Vapours being thus exalted in the Torrid Zone, the Waters under the other Zones must run on that Side to replace them, to which they are forced besides, by those which fall, as already observed, in the Frigid Zones.

The most Learned agree, that there is besides a general Current, from East to West, in the Torrid Zone, after they have considered how fast a Ship sails in those Seas, which most Mariners have attributed to the Wind. But it has been observed several Times, that to go from Peru to the Molucca's with a favourable Wind, the Voyage is accomplished in three Months: and that five or six Months are spent in coming back, steering the same Course, and with the same favourable Wind.

It is with some Appearance of Reason, that the Cause of that Current is attributed to the diurnal Motion of the Sun that Way, particularly if we observe that when the Sun is towards the Tropick of Cancer, that Current extends as far as beyond the 36° of northern Latitude.

It would be a very useful Thing if all Pilots would take Notice in their Journals of all the Currents they meet with at Sea, and observe exactly all the Circumstances thereof, whereby many Dangers would be avoided, and much Time and Expences saved. But however, till they be pleased to do that signal Service to their Fellow-Travellers, I'll give here a Detail of the most remarkable Currents which I have extracted from the most celebrated Authors.

In the Sea of Petzora, northward of Muscovy, are found Currents which run from East by North, from the Isle Kolgoy, through the Streights of Weygats, as far as the Mouth of the River Oby, in the Gulph which is between Tartary and New Zembla. There are in that Gulph monstrous Pieces of Ice, which must be carefully avoided, as being very dangerous to meet with.

Another is found from the North Cape, which comes from the North-West, and runs all along the Coasts of the Muscovite Laponia, as far as towards the Mouth of the Gulph of St. Nicholas, or White Sea.

There are very violent Currents along the Coasts of Arabia in the Ocean, and about the latter End of September great Tides and easterly Winds, which force the Ships as far as into the Red Sea, so that one must wait another Season to come out of that Gulph.

In a Voyage to the *East-Indies*, one must keep at least at an hundred Leagues Distance from the *Maldives*, because of the violent *Currents* which are there, and which force Ships against a great Number of little Shelves, whence they get off but very seldom.

North-West of *Gilolo* are very extraordinary *Currents*, particularly in the Streight of *Caldera*, where they roll sometimes northward and sometimes southward with so much Violence, that they have broke a Cable of 27 Inches, of a Ship which was at Anchor.

On the Coasts of *Guinea* the *Currents* carries always to the East-North-East, in the Gulph of *Benin*, so that if one will sail from the Gold-Coast to Cape *Gonsalvo*, between the Kingdoms of *Congo* and *Biafara*, in setting Sail from the Cape of the *Three Points*, one cannot take too much southward, because the *Currents* crossing the Course of the Ship, make it advance towards the South-East, so far as to reconnoitre the Isle of *St. Thomas*, which is under the Line.

Northwards of *Madagascar* is found a *Current*, which bears Northwards towards the Cape of *Gardafuy* on the Coasts of *Ajam*; and from the Bay of *St. Augustine*, which is in the southern Part of that Island, there is another *Current*, which runs from the North-East to the South-West, as far as the Cape of *Good Hope*; wherefore the *Europeans* have, sometimes, so much Difficulty to get round that Cape when they go to the *Indies*.

The Tides carry the Ships into the Gulph of *St. Lawrence* in *Canada*, during the Months of *June* and *July*; and, on the contrary, forced them out in the Months of *August* and *September*.

The *Mediterranean* is not free from *Currents*; one, in particular, is found in it, which entering through the Straights of *Gibraltar*, runs all along the Coasts of *Barbary*, descends towards the *Ostro Lebecio*, as far as into the *Great Syrt*; whence, re-ascending as far as Cape *Rasoun*, re-assumes its Course along the Coasts of *Barca* and *Egypt*; whence it re-ascends to *Tramontana*, coasting *Syria*, as far as into the Bottom of the Gulph *Lajuzro*, whence it returns Westwards, running between *Caramania* and the Isle of *Cyprus* as far as *Rhodes*.

The most probable Reason of this long *Current* is, that the Easterly Wind blowing on the Middle of the Sea, forces the Water towards the Straight, where finding a too narrow Passage, they return and flow along the Coast, where the Wind does not blow so hard.

The Entrance of the Straight of the *Dardanelles*, is extremely difficult, when wanted to sail from the *Archipelago* into the Sea of *Marmora*. And the Passage from this into the *Black Sea*, through the Straight of *Constantinople*, is not much easier, because of the large Rivers which disembogue into this last Sea; for not only the *Danube* and *Borysthenes* send their Waters thither, but the *Don* likewise, which falls into the *Zabache*, rolls its Waters into it through the Straight of *Cassa*. Therefore the *Black Sea* is forced to empty as much of those Waters as it receives into the Sea of *Marmora*, and this into the *Archipelago*. It was this *Current* that obliged *Aristotle* to say, that the Sea had a Course from North to South.

There are, besides, *under Currents*; and Dr. *Halley* makes it highly probable, that in the *Downs*, in the Straights of *Gibraltar*, &c. there is an *under Current*, whereby as much Water is carried out as is brought in by the upper *Current*.

This he argues from the *Offing* between the North and South *Foreland*, where it runs Tide and half Tide, *i. e.* it is either Ebb, or Flood, in that Part of the *Downs*, three Hours, ere it is so off at Sea: A certain Sign that though the Tide of Flood runs aloft, yet the Tide of Ebb runs under foot, *i. e.* close by the Ground; and so at the Tide of Ebb it will flow under-foot.

This he confirms by an Experiment in the *Baltick Sound*, communicated to him by an able Seaman present at the making it; being there, then, with one of his *Britannick Majesty's* Frigates, they went with their Pinnace into the Mid-stream, and were carried violently by the *Current*. Soon after that, they sunk a Basket with a large Cannon-Bullet to a certain Depth of Water, which gave Check to the Boat's Motion; and sinking it still lower and lower, the Boat was driven a-head to the Windward, against the *upper Current*; the *Current*

aloft not being above four, or five Fathoms deep: He added, that the lower the Basket was let down, the stronger the *under Current* was found.

From this Principle it is easy to account for that vast Draught of Water continually pouring in with the *Current* out of the *Atlantick* into the *Mediterranean*, through the Straights of *Gibraltar*; a Passage about twenty Miles broad, yet without any sensible Rising of the Water along the Coasts of *Barbary*, &c. or any overflowing of the Lands, which there lie very low.

One of the most necessary Things in Navigation, especially *proper Navigation*, or what the *French* call *Voyages de long Cours*, is to know how to chuse the Season proper to set Sail; to avoid the contrary Winds, and dangerous *Currents*, found at certain Times in some Places of the Sea.

The *French*, and *English*, who will go to the *East-Indies*, must set sail in the Beginning of *March*, to avoid the Calms of the Line, which reign about the Equinoxes, and the dangerous *Currents*, which carry the Ships towards the Coasts of *Guinea*: After a Sight of the Cape *Verd* Islands, one must not take Land this Side of the Cape of *Good Hope*, that one may pass the Line towards the Middle of *July* at latest.

To return from the *Indies* into *France*, or *England*, one must set sail in the Month of *December*, to double the Cape of *Good Hope* at the Beginning of *May*, coming afterwards to reconnoitre the Isle of *St. Helen*; and from thence those of the Cape *Verd*.

The Ships for *Ormuz* set sail in the Month of *January*, to double the Cape the Beginning of *May*.

Those for *New France* and *Newfoundland*, set sail about the Middle of *March*, and set sail from thence about the latter End of *July*, to be in *France* at the Beginning of *October*.

The *Dutch*, who trade commonly on the Coasts of *Africa*, for their Voyage to the Isles of the *Sound*, to the *Molucca's* and to *Japan*, set sail from the *Texel* in the Months of *June* and *July* to be there in the Month of *April*.

If they set sail in that Season, it is because they want to arrive at the Isles before Winter, which begins about the latter End of *April*, and which is very disagreeable, not for the Cold and Ice, for there is none in those Climates; but for the violent and continual Rains, often accompanied with Thunder and Tempests.

That rainy Season, which lasts from the latter End of *April* to the latter End of *September*, is no less hot throughout all the *East-Indies*, than the rest of the Year.

But one of the most essential Points in a *proper Navigator*, is to know how to take exactly the *Altitude*, which to perform we must remember, 1. That the Latitude of a Place is always equal to the Elevation of the Pole on its Horizon; that what we call Elevation of the Pole is the Arch of the Meridian comprized between that Pole and the Horizon; and what we call Elevation of the Equator is likewise the Arch of the Meridian comprized between that Circle and the Horizon.—2. That the Elevation of the Pole and that of the Equator make up together the Value of a Right-Angle: For there being always a Demi-circle of the Meridians on the Horizon; and the Arch which is between the Pole and the Equator, containing a Quarter of a Circle, the Elevation of the Pole and that of the Equator must contain the other.

The Utility arising from this Observation, is that if we know either of these Elevations, we can presently know that which we cannot observe.

Sometimes the Nights are so thick of Clouds and Fogs that we can see no Stars to have the *Altitude* of the Pole; and sometimes we are a whole Month at Sea without finding a single Moment to observe the *Altitude* of the Sun. During that whole Time the Compass alone serves for the Conduct of the Ship: And the most experienced Pilot cannot say positively where he is, and the Safety of the Ship depends entirely on his Conjectures founded on his Experience, and on the Estimate he makes of the Course of the Ship according to the Wind he has had.

If we want to observe the *Altitude* of the Pole, we must observe, first, on what Side the North Star is.

Compass shews the North, and discovers there the polar Star, which is never distant from the Pole above $2^{\circ} 41'$. Then holding our Quadrant horizontally, *i. e.* the immovable Branch (on which there are Pinules) parallel to the Horizon, we raise or lower the *Alidade*, so that we discover the Star through the two Holes of the Pinules, and the Arch comprized between the immovable Branch, and the *Alidade*, will be very near the *Altitude* of the Pole, according as the Star will be above, or under, or on the Side.

If we will observe the Sun, Moon, or some other Planet, and take the *Altitude* thereof to discover thereby the Elevation of the Pole, and consequently the Latitude of the Place where we are, we must have Tables of the Declination of those Planets, *i. e.* Tables which mark for every Day of the Year, how far they are distant from the Plan of the Equator, towards the one or other Pole, and that Distance which is the Arch of a Meridian comprized between the Equator, and the Star we want to observe, is what is called its Declination.

Suppose then we have those Tables, if we will take the Height of the Sun, for Instance, the 21st of April, and we find it, exactly at Twelve at Noon, risen of 60 Degrees above the Horizon, we must search in the Tables the 21st of April, and we'll see that that Day the Sun declines 11 Deg. 30 Min. towards the North, *i. e.* that he is at that Distance from the Equator; and therefore that Place of the Observation will have 41 Deg. 30 Min. of Elevation of the Pole, and as much of Latitude.

If in observing the Sun the 22^d of October, it was found as much risen on the Horizon, we should observe, then, that the Declination of that Planet being towards the Antarctick Pole, the Place of the Observation would be, likewise, in the southern Hemisphere at 41 Deg. 30 Min. of Elevation of the Pole, and of Latitude.

If in taking the Height of the Sun the 22^d of October, it was found risen 30 Degrees of the Horizon, it will be observed, as I have said already, that the Sun declines that Day, on the Side of the Antarctick Pole, 11 Deg. 30 Min. *i. e.* that he is lower than the Plan of the Equator, of that Quantity; therefore that Declination must be added to the Elevation of the Sun; the two Quantities joined together, which make 41 Deg. 30 Min. will give the Elevation of the Equator, the Complement whereof in the Quadrant 48 Deg. 30 Min. is the Elevation of the Poles, and the *Latitude* of the Place where we are.

If we were to find the Sun risen of the same Quantity the 21st of April; having observed that he declines northward, after having joined together, as in the preceding Article, the Elevation of the Sun, and its Declination, we'll find that the Place of the Observation is in the southern Hemisphere, *i. e.* beyond the Line at 48 Degrees 30 Minutes of Latitude.

M. Parent, a Frenchman, suggests a new Method of taking *Altitudes* at Sea, by a common Watch. 'Tis obvious, that in an oblique Sphere the Difference between the Rising and Setting of two Stars, on the same Meridian, is greater, as they are further distant from one another.

Now the Astronomical Tables furnishing us with Tables of the right Ascensions, and Declinations of all the fixed Stars; it is easy, after observing the Difference of Time between the Rising of two Stars, to distinguish that Part of the Difference which accrues from their different Position, from that which arises from the Obliquity of the Sphere.—But such Difference is the precise Height of the Pole of the Place of Observation.

Indeed the Ship not being immovable, but changing Places between the two Observations, seems to lay the Method under some Difficulty; but M. Parent answers, that a small Alteration either of the Ship's Longitude or Latitude, will make no sensible Error; and that if she have gone a large Distance between the two Observations, it is easy reckoning how much it is, and allowing for it.

In taking of *Altitudes* from the visible Horizon, where great Exactness is required, an Allowance is to be made for Refraction, and the Height of the Observer's Eye above the Surface of the Sea.

As for the *Longitude*, it is the Philosopher's Stone; of *Navigation*, which has been, and is still searched with much Eagerness, but could not be found yet: For my Part I question much which of the two is more likely to be found, either that which is the Idol of the Alchemists, and to which they sacrifice all they have the most dear in this World; and I am afraid that the Wind will deceive by his Inconstancy the Expectation of those who search the first, as the Sinoak carries off the Hope of the others by its Levity. Those who, like me, will reflect on the Inconstancy of the Wind, the Irregularity of the Currents, the Diversity of the Ships, and the different Form and Position of the Sails, the Declination of the Magnet; and lastly, on all the various Effects which can result from so many irregular Things, will find that it is morally impossible to make an exact Estimate of the Course of a Ship at Sea.

The precious Secret of knowing the Longitude is the true Powder of Projection, which would set that *grand Work* in its Apogæum; but to work at it, with Hopes of Success, one should have a Point fix'd in the concave Superficy of the Heavens, besides the Poles; as, antiently, *Archimedes* asked for one to ballance the whole Globe of the Earth with the Help of a Lever. For the Motion of the Stars which can help to that Discovery, is not precisely enough known to us, to draw from them infallible Consequences.

That Secret is of such an Importance, that the *English*, *French*, and *Dutch*, interested in the Commerce of the *Indies*, have promised great Rewards to the Person who should be so happy to discover that marvellous Problem, which has been the Subject of the Meditation of a vast Number of learned Men, ever since two or three Centuries.

It is easy to know the Utility thereof; for if we could observe under what Degree of Longitude a Ship is arrived, as we know the Latitude where she is at the Time of the Observation, we could precisely mark the Point, and consequently the Course it could have made from a certain Place.

What most of those who search the *Longitude* aim at, is a Method of determining the Difference of Time between any two Points of the Earth; for every 15 Degrees of the Equator answering to an Hour, *i. e.* one Degree to four Minutes of Time, and one Minute of a Degree to 15 Seconds of Time; the Difference of Time being known and turned into Degrees, will give the *Longitude*, and *vice versa*.

This some have pretended to effect by Clocks, Watches, and other Automata, but always in vain; no Time-Keeper, except a Pendulum (which cannot be applied at Sea) being sufficiently sure and exact for the Purpose.

Others, with more Probability, and to better Purpose, seek for Means to search the Longitude in the Heavens: For, if the exact Times of any celestial Appearance be known for two Places, the Difference of those Times gives that of the Longitude of those Places.—Now in the Ephemerides, we have the Motions of the Planets, and the Time of all the celestial Phenomena, as the Beginning and Ending of Eclipses, Conjunction of the Moon with other Planets, its Entrance into the Ecliptick, &c. accurately calculated for some one Place. Therefore if the Hour and Minute be known, wherein any of the same Phenomena's are observed in an unknown Place, the Difference between the Hour and Minute of that Place, and that other to which the Tables are calculated, and consequently the Difference of their Meridians, and their *Longitude* from each other are known also.

Now the Difficulty here does not consist in the exact finding of the Time, which is easily had from the Sun's Altitude, or Azimuth; but the Defect lies in the Paucity of Appearances capable of being thus observed: For all slow Motions (*v. gr.* that of *Saturn*) are at once excluded; as shewing but little Difference in a considerable Space of Time; and it being here required, that the Phenomenon be sensibly varied in two Minutes of Time, an Error of two Minutes in Time producing another of 30 Miles in the *Longitude*. Now there are no Phenomena's in the Heavens that have these Requisites, excepting the several Stages of an Eclipse of the

the Moon; her Longitude or Place in the Zodiack; her Distance from the fixed Stars; her Appulse to them; her Ingress into the Ecliptick, or the Points of her Orbit, where that cuts the Ecliptick; and the Conjunction, Distance, and Eclipses of *Jupiter's* Satellites. Of each of which in their Order.

1. The Method by the Eclipses of the Moon, is very easy, and sufficiently accurate, were there but Eclipses every Night. At the Moment wherein we see the Beginning or Middle of a lunar Eclipse by a Telescope, we have nothing to do but take the Altitude or Azimuth of some fixed Star, from which the Hour and Minute are easily found; or without the Altitude if the Star be in the Meridian. This Hour and Minute therefore thus found, and compared with that expressed in the Tables, give the Longitude.

2. The Moon's Place in the Zodiack, is a Phænomenon more frequent than that of her Eclipses; but then the Observation thereof is difficult. The *Calculus* intricate and perplexed, by Reason of two Parallels; so that it is scarce practicable to any tolerable Degree of Accuracy. Indeed by waiting till the Moon comes into the Meridian of the Place, and then taking the Altitude of some remarkable Star (the Altitude being supposed to be first known) from this Altitude and the Latitude, we shall be able to find the Time pretty accurately; though it will be better to do it by some Star in the Meridian. Now the Time being found, it will be easy to find what Point of the Ecliptick is then in the Meridian or Mid-Heaven. Thus we shall have the Moon's Place in the Zodiack, corresponding to the Time of our Place. Then in the *Ephemeris*, we find what Hour it is in the Meridian of the *Ephemeris*, when the Moon is in that Part of the Zodiack: Thus we shall have the Hour and Minute of the two Places for the same Time; the Difference of which will give the Difference of a Longitude.

3. In Regard there are many Times when the Moon cannot be observed in the Meridian, there is therefore another still more frequent Phænomenon, from which the Longitude is sought, *viz.* the Moon's Appulse and Recess from the fixed Stars: For from thence the Moon's true Place may be investigated for the given Time of Observation. But this Method, by Reason of the Parallaxes, and the Solution of oblique spherical Triangles, and the various Cases, is so very difficult and perplexed, that Mariners will scarce be able to make Use of it; nor does it seem necessary to give the Praxis thereof. Those, however, who are disposed to use it will find very great Help in it from a starry Zodiack, published under the Direction of Dr. *Halley*, containing all the Stars to which the Moon's Appulse can be observed.

4. To find the Longitude by the Moon's Ingress into the Ecliptick, observe the Moment of that Ingress: Then, in the *Ephemeris*, see what Hour it is in the Meridian of the *Ephemeris*, when that Ingress happens. The Difference between these Times, gives the Difference of Longitude.

5. The Phænomena of *Jupiter's* Satellites are generally preferred to those of the Moon, for finding the Longitude; by Reason the former are less liable to Parallaxes, and do further afford a very commodious Observation, in every Situation of that Planet above the Horizon. Their Motion is very swift, and must be calculated for every Hour; and for that Reason are not found in the common *Ephemerides*, but are had elsewhere.

Now to find the Longitude by Means of these Satellites; with a good Telescope, observe the Conjunction of two of them, or of one of them with *Jupiter*, or any other the like Appearance; and at the same Time, find the Hour and Minute from the Meridian Altitude of some Star; then consulting Tables of the Satellites, observe the Hour and Minute wherein such Appearance happens in the Meridian of the Place, to which the Tables are calculated. The Difference of Time as before will give the Longitude.

All Methods which depend on the Phænomena of the Heavens, having this one Defect, that they cannot be observed at all Times; and being, besides, difficult of Application at Sea, by Reason of the Motion of the Ship; there are some who leaving the Moon, and the Satellites have Recourse to Clocks, and others *Automata*; which could they be made perfectly just and regular, so as to

move with the Sun, without either gaining or losing, and without being affected with the Change of Air, and of Climates, the Longitude would be had with all the Ease and Accuracy imaginable; nothing more being required but to set the Machine by the Sun, at the Time of Departure: And when the Longitude of any Place is desired, to find the Hour and Minute from the Heavens (which is done at Night by the Stars, and in the Day by the Sun) for the Difference between the Time, thus observed, and that of the Machine, gives the Longitude. But no such Machine has been yet discovered: Wherefore Recourse has been still further had to other Methods.

Mr. *Whiston*, and Mr. *Ditton*, have proposed a Method of determining the Longitude, by the Flash and Report of great Guns. Sounds, it is known, move pretty equal in all their Stages, whatever the sonorous Body be that occasions them, or whatever the Medium that conveys them. If then a Mortar or great Gun be exploded at a Place, whose Longitude is known, the Difference between the Time wherein the Flash (which moves, as it were instantaneously) is seen, and the Sound, which moves at the Rate of four Seconds in a Mile, is heard, will give the Distance of those Places from each other; whence if their Latitude be known, the Difference of Longitude will be likewise known.

Again, if the Hour and Minute of the Explosion be known (or the Place where it is made) by observing the Hour and Minute from the Sun or Stars, at the Place whose Longitude is required; the Difference between those Times, will give the Difference of Longitude.

Again, if the said Mortar be loaden with an Iron Shell full of combustible Matter, and posited perpendicularly, it will carry the same a Mile high, will be seen near a hundred Miles; if therefore neither the Sound should be heard, nor the Flash seen, the Distance of any remote Place from the Place of the Mortar, may be determined from the Altitude of the Shell above the Horizon of the Place unknown: And the Distance and Latitude known, the Longitude is easily known.

According to this Scheme, it was proposed to have such Mortars fixed at certain Distances, and at known Stations, on all the frequented Coasts, Islands, Capes, &c. and to be exploded at certain Hours, for the Observation of Mariners.

This Method, though good in the Theory, yet is found useless in the Practice, as being extremely troublesome, and yet precarious. It supposes that Sounds may be heard 40, 50, or 60 Miles; of which it is true we have Instances, but they are very rare; and ordinarily the Report of a Cannon is not heard above half so far, and sometimes much less. It supposes again Sound to move always with equal Velocity, whereas, in fact, its Velocity is increased or diminished, as it moves with, or against the Wind. It supposes again the Strength of Powder uniform; and that the same Quantity carries the same Range; the contrary whereof is known to every Gunner. We say nothing of thick cloudy Nights, when no Lights can be seen; nor of stormy Nights, when no Sound can be heard; even at inconsiderable Distances.

We have another Method of finding the Longitude, proposed by the same Mr. *Whiston*, *viz.* by the *inclinator*, or *dipping Needle*, but all to no Purpose.

Therefore we cannot have the Distance of a Ship, or Place, East or West from another, counted in Degrees of the Equator, but by Estimation.

That Estimation is the Judgment of the Course we think to have run at Sea, in following a certain Rhumb, with such or such Wind, &c. which till now, has been a Thing entirely of Practice; and which the most learned Pilot cannot give but by Conjectures, and even that after a long Experience, and very exact Observations, *i. e.* that having sailed a long Time in the same Ship, he must have made Memoirs of the Rhumbs he has followed, of the Winds which have blowed, and of the Time expired, while he has run his Course from one Place to another, of which he may know the Distances. For Instance, having set Sail from the Bay of *Brest* for *Bourdeaux*, Things happen to him in the following Manner, and he must mark them thus:

Having set Sail from the Bay of *Brest*, at 8 in the Morning,

Morning, and at the Altitude of $47^{\circ} 50'$ of Latitude, under 15° of Longitude, in a Ship of such Burthen, it blew a North Wind, and having followed the South by South-West, I have run 45 Miles, or 15 Leagues in 5 Hours. Being arrived at the Altitude of the Rocks of *Penmark*, the same Wind continuing, I have put the Cape to the South-East, and in 4 Hours I have run but 5 Leagues. At Night, the Wind having turned to the West, I kept always the same Rhumb, to have a quarter Wind, and leaving *Belle-Isle* on the left, I discover'd far off, the next Day at Noon, the Isle of *Oleron*, so that I run 40 Leagues in 16 Hours; and thus of the rest.

I suppose here, that he had had all his Sails out; but if he had some of them furled he should mention it, by specifying which Sails, in following such Rhumb, with such Wind, I have run such Space, in such Time, with such Loading.

That's the most common Method, and the most commonly followed by Pilots; whereby we may easily know, that it is but after a great Number of different Voyages, and several very accurate Remarks, that we can account for the Space we have run, in a certain Time; and then that Account is not certain.

After what I have said, we must confess, that we must have regard to several particular Things, to make a good Estimation. The first is the Quantity of the Sails, their Form, and different Position. The second is the Rhumb we will follow, to which we must add the Declination of the Needle. The third is the Variety and Quality of the Winds. The fourth is the Quantity of the Space the Ship runs, and how to measure it. The fifth is the Time the Ship employs in running a certain Space. The sixth is the Burthen of the Ship, and the Manner of loading it.

An experienced Pilot, which has exactly observed all these particular Things; the Irregularity whercof could render his Estimation erroneous, will certainly make it with a greater Accuracy, than another who has had no Regard to those Things: Therefore he must follow the following Method.

Suppose a Ship be departed from a Place under the 30° of Latitude, and the 345 of Longitude, to go to another Place 100 Leagues distant from it; if she sails always under the same Meridian from South to North, without changing Rhumb, it is evident, that when the Pilot will be arrived at a Place, which after he has taken his Observation, he'll find to be at 33° of Latitude, he'll be sure, that he has sailed 60 Leagues; and if by Means of his Horloge, he finds that he has run that Course in the Space of 24 Hours, he may promise himself to be at the End of his Journey in 16 Hours, if he has always the same Wind, and if he meets with no Obstacles.

But if departing from the same Place, he wants to go to one under the $37^{\circ} 30'$ of Latitude, and the 354 of Longitude, towards the North-East. When he shall have sailed for some time by the same Rhumb, if he finds the Pole risen of 35 Degrees, he is sure already, that he is on the Parallel 35; and to know in what Point, he shall examine the Calculation of the Course of the Ship by the same Rhumb, in the Distance of a Degree of Latitude, viz. 84800 Paces, or about 28 Leagues and a $\frac{1}{4}$; therefore in the Extent of 5° , he must run 424000 Paces, or 140 Leagues and $\frac{1}{3}$. In taking with a Compass that Distance, he shall place one of the Points thereon on the Point of the Departure, and with the other tracing a small Arch of a Circle, the Point where he'll cut the Parallel 35, will be the Place where the Ship was arrived at the Time of the Observation.

This Estimation may be verified by Means of the Horloge, in the following Manner, if we have observed the Latitude, by Means of the meridional Altitude of the Sun; for if in that Moment we have took Notice what Hour the Pendulum or Hour-Glass marked, and it was 11, 36 Minutes, we may say that the Ship has advanced Eastward of 6° of Longitude: Because the Sun is in its Meridian 24 Minutes sooner than he is in that of the Place whence the Ship departed. For we must remember that I have observed in my Treatise of *Astronomy*, that the Sun runs 15° of his Circle in one Hour. Therefore, if bearing the Space of $141\frac{1}{3}$ Leagues from the Point of the Departure of the Ship to that of

its Arrival, the Point of the Arrival is found under the 35° of Longitude, it is in some Measure the Confirmation of our Estimation.

If we are apprehensive that the Tide, or some Current has made our Ship run a Drift, so that we have not followed the Rhumb marked by the Compass, we'll make the Estimation of the Rout which we believe to have run. Suppose we have reckoned to have run 180 Leagues, if we find the Altitude of the Pole of 35° , we'll bear the Distance of 180 Leagues of the Scale of the Point of Departure, to cut the Parallel 35, in the Point of our Arrival.

We'll know thereby, that we are on the 354° of Longitude, which is the Meridian of the Point, where we want to go, and consequently that we must turn the Cape to the North, to arrive at that Place, and that we are yet 50 Leagues distant from it. We'll know, besides, that believing we have followed the Rhumb North-East, we have sailed North East by East, which shall be expressed in our Journal in these Terms. We have put the Cape to the North-East, which was worth to us North-East by East, because of the Currents or Tides.

This Estimation may be verified as the first, or by examining the Calculation of the Rout made each Rhumb, in the Distance of a Degree of Latitude. If we find that by the fifth Rhumb we should make 180 Leagues in the Extent of 5° , the Estimation will be very well made.

But if you doubt equally of the Rout and Rhumb, and you are not sure of having made 180 Leagues, because you have observed the Wind a little weak; if you are afraid, besides, of having too much run a Drift, because of some Current, or that the Compass north-wards a little, you'll correct the Rout and Rhumb. We'll place our Point at another Distance, so that we'll reckon to have sailed between the 4th and 5th Rhumb, and to have only run 160 Leagues.

If departing from one Point, we think that we follow the Parallel $37\frac{1}{2}$, and that after having sailed 3 Days, we reckon to have run 160 Leagues, and be arrived at such a Point; but having taken our Observation, we'll find ourselves $3^{\circ}, 30'$, higher than our Estimation, we must trace an Arch of a Circle of the Interval of the Point we are departed from, and that we thought ourselves arrived at, which is 160 Leagues; and the Point where that Arch shall cut the 40 parallel, will be that of the Observation. Thus we'll know, that instead of sailing Eastward, we have followed the Rhumb East-North-East; which we must mark on our Journal.

This Estimation can be verified, like the others, by the Longitude; or by the Calculation of the Course of each Rhumb.

A Pilot, sometimes, after he has sailed a long while on the same Parallel Eastward or Westward, imagines, that he has run a great Length: Which notwithstanding, instead of arriving at the Place of his Destination, he returns back, as it happens very often in the Torrid Zone, because of the Currents which run Westward. All that can undeceive him, is the Time expired ever since his Departure; which he must observe exactly, when he'll take the Meridian Altitude of the Sun.

For Instance, if he has been exact in turning his Hour-Glass, which is of half an Hour, and observing, that at the Hour the Sun is in the Meridian of the Place where he is, the Hour-Glass has been turned 197 Times, ever since he placed it at 12 at Noon, at the Place whence he departed, he must presume that it is half an Hour after 12 at that Place, and that two Days are elapsed, because 197 half Hours make twice 24 Hours, and a half Hour more; and of Consequence he must reckon that he has sailed back Westward of $7^{\circ} 30'$, which he can reduce into Leagues, knowing under what Parallel, by Means of the Table of Reduction.

If the Hour-Glass has been turned but 195, in the Instant of the Observation, it is a Mark that one has sailed forwards of $4^{\circ} 30'$, which must be reduced likewise.

In long Voyages, a Pilot is sometimes several Days without seeing either the Sun or the Stars; so that as he cannot take the Altitude, nor discover if his Compass declines, he cannot make his Estimation, but by the Extent of the Course he imagines he has run.

Suppose we set sail from such a Point, before the

Wind, which we reckon East by South-East; after we have run 120 Leagues, we believe to be arrived at such a Point, whence turning the Cape to the North-North-West, after we have sailed some Days, we reckon to have run 100 Leagues with a good Wind; and being arrived to such a Point of that Place, sailing to the North-West by North, we reckon to have run 60 Leagues; and be arrived under 49° of Latitude, and the 351° of Longitude. During that long Course, composed of different Rhumbs, I suppose that the Pilot could take neither the Altitude of the Sun, nor that of the Stars, to verify his Estimation, before he was arrived under the 49° of Latitude.

But if by that Observation he finds that he is under the $50^{\circ} 45'$. It is a Mark that there is some Error in his Estimation of the Course, or of the Rhumb; or perhaps in both. If he be, in some Measure, sure of the Course, and he doubts of the Rhumb, either because of the Currents, or that the Compass north-wards, he'll keep the Length of the Course, and change the Rhumbs in the following Manner.

Instead of fixing the Point of his first Estimation, where he had fixed it after he had run 120 Leagues, he'll fix it in another Place distant, likewise, from the Point of his Departure, but $\frac{1}{4}$ of a Rhumb more northward, *i.e.* that he shall have followed the West-North-West, instead of the West by North-West. He'll do the same of the 100 Leagues Distance, which he'll carry on the Rhumb, North by North-West, instead of the North-North-West, which he believes to have followed. Lastly, he'll carry the Distance of 60 Leagues on the Parallel $50-45$, and he'll know, that instead of having followed the North-West, he has sailed by the North-North-West; and that reckoning to be under the 351° of Longitude, he'll be under the $354^{\circ} 30'$.

If he be more sure of the Rhumbs than of the Quantity of the Course, as it may happen; after he has observed that the Needle of the Compass does not decline, or when the Course has been directed according to the Declination; but that he has observed, or imagines, that some Current has drove away his Ship, or that the Wind has been stronger than usual, in that Case he must keep the same Rhumbs, but correct the Estimation of the Course in the following Manner.

If he judges that in setting Sail by the Rhumb West by North-West, the Wind has been strong enough, or that a Current has carried him off, so that it has been capable to make him run one fifth faster than he thought; he'll change the Point of his first Observation, 30 Leagues more forwards; then drawing a Line to the North-North-West, he is sure he has followed, he'll carry to it the Distance of 125 Leagues, instead of that of 100 Leagues, provided he judges that the Winds or Currents have made him sail swifter by one fifth, than he had reckoned the first Time: Otherwise he'll mark the Point of that second Observation higher or lower, according as he judges the Wind has blowed. The third Distance will be marked, likewise, on the North-West Rhumb, and he'll judge thereby, if he was not mistaken in the others. For it can neither be increased nor diminished, without correcting the others: Because he is forced by the Rhumb whereof he believes himself sure; and by the Altitude he finds himself in. That Distance is found about 75 Leagues, which includes still a fifth more than the 60 Leagues Distance.

It must be observed, that what I have said of a fifth Part of the Course which I have added, more than the first Estimation, is but a Supposition, and that the Winds or Tides can make a Ship, sometimes double, or a Third, or a Fourth, more or less: What an intelligent Pilot must observe with Care.

Lastly, let a Pilot be ever so experienced, and let him have made what Remarks he pleases, he cannot say precisely the Place where he is arrived, unless he discovers Land, or some other remarkable Things, as Isles, Rocks, certain Fishes, and certain Sorts of Birds, which are particular, and in great Number in some Parts of the Sea, the Soil brought from the Bottom of the Water with the sounding Line; and several other particular Things, which Pilots observe, and mention in the Relations of Voyages.

For Instance, in sailing on the *Ethiopian* Ocean, flying

Fishes are seen, which rise by Shoals in the Neighbourhood of the Island *St. Thomas*; I have seen the same Thing under the Tropicks. Towards the Cape of *Good Hope* are found Sea-Wolves in great Number, and white Birds as big as Swans, which the *Portuguese* call *Mangas de Velugo*, Velvet-Sleeves, because they have the Tip of the Wings black. And another Sort almost like the *Halcyons*, except that they are spotted with black. In sailing towards *New France*, are found certain Birds, called *Martelets*; which is a Mark that one is not far from the great Bank. In sailing from *Bander-Abassi*, or the Gulph of *Ormuz*, towards *Cambaya*, a Pilot knows that he is not very far from the Coasts, when he sees Cranes, and a great Quantity of white and round Fishes, called *Testons*. Above the Isles of *Cape Verd* between the 20° and 34° of Latitude, is found a pretty spacious Space in the Sea, all cover'd over with a Herb, almost like the *Portuguese* Parsley, and which, for that Reason, the *Portuguese* call *Sea of Sargasse*. It is probable, that *Columbus* met with those Herbs in his first Voyage towards *America*, which frighten'd him so much, that he was in Suspense if he should continue his Voyage or not.

With Respect to the Pointing of Charts.—What is called *Pointing of a Chart*, is to mark on that Chart the Place where one reckons the Ship is arrived at; which must be done every Time a Pilot quits his Watch, which commonly lasts three Hours; marking on his Journal the Latitude and Longitude of that Point, according to the Estimation made.

One may follow the following Practice. Suppose a Pilot be departed from a Point under the Parallel 60, and the 20° of Longitude; and judges to have sailed 60 Leagues by the South-West, he'll search in his Chart the nearest Rose of Winds, and draw a Line parallel to the Rhumb South-West: Then having took on his Scale, under the Parallel 60, the Distance of 60 Leagues; he'll place one of the Points of the Compass on the left Extream of the Line, and the other Point shall fall on the right Extream, which is under the $57^{\circ} 50'$ of Latitude, and the $357^{\circ} 35'$ of Longitude, where he'll reckon that the Ship is arrived. From the right Extream of the Line, if he believes that he has run 68 Leagues, he'll trace, likewise another Line parallel to that Rhumb, on which having carried the Distance of the 60 Leagues, taken on the Scale, above the Parallel 55; he'll mark a Point under the 55° of Latitude, and the 354° of Longitude.

They make use, likewise, of a Rose of Horn, or of other transparent Matter, on which the 32 Rhumbs of Winds are exactly traced. The Pilot applies the Rose on the Chart, so that the Center be on the Place, whence the Ship departed, and the Lines of the North and South both agree together, or be parallel between themselves. Then having took with a Compass on the Scale, the Distance of the Course he'll reckon to have made, he'll carry it on the Rhumb, he thinks he has followed, placing one Point of the Compass on the Place whence he departed, therefore the Place which the other Point marks on that Rhumb, is the Place where he thinks himself arrived.

Suppose, for Example, that a Ship be departed from a Point under the 10° of Longitude, and the 60 Parallel; that he has followed the Rhumb South-West, and the Pilot believes that he has run 56 Leagues; he'll place the Center of the Rose of the Horn, on the Point under the 10° of Longitude, so that the Line of the South be along the Meridian 10, he'll draw, if he will, another Line with some Points on the Rhumb South-West, to take the Distance of 56 Leagues on the Scale, under the Parallel 60, and carry it on the Line of 10° of Longitude, to the Place where he'll reckon the Ship is arrived.

He knows by that Operation, that he is under the 58° of Latitude, and the 6 of Longitude; which he'll observe in his Journal in these Terms: Such a Day, after we had sailed so long by the South-West, we found ourselves under the 58° of Latitude, and 6 distant from the *Canaries*, if the Chart be of *France*, or of 13° of the *Azores*, if it be of *Holland*; and thus of others.

Those who have not well reflected on what I have said of the Construction of Scales of reduced Charts, will not conceive at first, perhaps, why I say that the Distance of the Leagues must be taken on the Scale, sometimes under the Parallel 60, and sometimes above the 55; but it is

easy to judge that it is because of the Inequality given to the Degrees of Latitude; and since the Distance between the two Extrems of the Line drawn parallel to the Rhumb South-West, is comprized between the Parallels 58 and 60; one must measure by the Degrees or Leagues of the Scale, which are comprized between those Parallels. And because the Obliquity of the Rhumb makes, very often, that Distance much greater than those Degrees of the Scale, which contain but 20 Leagues each, one must take the Extent of the Degrees between which it is comprized, and carry it as many Times as it can be contained on the Line parallel to the Rhumb South-West; if it be of 3 Degrees, or 60 Leagues, it must be carried to it once and a half, to mark the Point on the right.

We must do the same of the Distance of 60 Leagues, comprized between the Parallels 55 and 58, or take the Extent of 3 Degrees of Latitude, which make 60 Leagues, which we'll carry on that Distance of 68 Leagues: To which we'll add, besides, the Value of 8 Leagues, which we'll take on the Degree of Latitude, or of the Scale which answers to the Line comprized between the Parallels 55 and 58; which is the mean Proportional wherewith the whole Distance of 60 Leagues could be measured.

Note, That as it is easily understood by what I have said on the Estimation of the Course of the Ship, that we sail only by Supposition, with Respect to the Longitude, which has not been found yet, and in all Appearance never will, we cannot sail with too much Caution, when we judge ourselves pretty near the Land, for fear of going to break our Nose upon it, which is but too often the Fate of *English* Commanders; who, by an Excess of Presumption, of which their Owners are daily the unhappy Victims, come full Sail, wreck themselves on their own Coasts, even, often, when the Sea and Winds are the most favourable to them. There should be a very severe Punishment for such rash Masters of Ships, who thus sacrifice the Fortune of several Families to their Temerity, whereby they would be obliged to sail with the same Caution the *French* do, for as soon as they think themselves near Land, they lower their Sails, especially in the Night, or in a very cloudy Horizon; they seldom have, then, more Sails out than their Fore and Fore-Top Sail, and this last on the Ton; unless they are obliged to tack about. Neither are they allowed to enter certain Roads or Ports, without a Coasting Pilot; and the Commander of a Ship who acts otherwise, and in the Attempt loses his Ship, is severely punish'd, if not hang'd. For the Accomplishments of a Master of a Ship, do not consist only in knowing perfectly well the Distances of Places, the Rhumbs of Winds he must follow to arrive at the Place of his Destination, how to make his Observations, correct his Reckoning, point his Chart, &c. but he must be, likewise, very well acquainted with what the *French* call *Manœuvre*, or working of the Ship; be very attentive to the Wind, in order to make of it all the Advantage he can, to go forward on his Voyage, order the Steerer to move his Whip-Staff, or wheel accordingly; and dispose his Sails according as the Wind serves. If he sails before the Wind, or has, what the *French* call *Ventarrière*, the Main-Sail, Main-Top-Sail, Main-Top-Gallant, Fore-Sail, Fore-Top-Sail, the Sprit-Sail, the Main-Cape-Sails, can serve, and even the Mizzen-Top-Sail; but a Point must be bargued in the Main-Sail, the Main-Top-Sail brought down on the Ton, and a Point likewise bargued in the Fore-Sail, if the Sprit-Sail be unfurled, otherwise those two Sails would be of very little Use. If such a Wind blows very hard, the Main-Top-Sail, Fore and Fore-Top-Sails, are sufficient. Of a good Side-Wind, all Sails can serve, except the Mizzen-Sail which is seldom used, unless it be to *mettre a la cape*, in a hard contrary Wind. We likewise put *a la cape* with the Main-Sail, to hinder the Ship from going too much to the Drift, and keeping it more steady. To sail near the Wind, the Main-Sail, Fore-Sail, and even the Mizzen-Sail may serve; but the Bowline of the Main-Sail must be halled very tight, especially if the

Wind be very near. In a Storm we are often obliged to be without Sails at all.

To distinguish the different Nations at Sea, there have been invented *Colours*, *Antients*, *Standards*, &c. of different Colours and Shapes, *viz.*

The *Royal French* FLAG, is white, strewed all over with Gold *Flowers de lis*; and charged with an Escutcheon of the Arms of *France*, environ'd with the Collars of the King's Orders. The *French* Flag is white.

The Royal Standard of the *Real Galley* of *France*, is split, and of three Bends, one red, the other white, and the third red. On that of the Middle, which is white, is an oval Escutcheon, Azure charged with three *Flowers de lis*, Gold.

The Flag of the *French* Gallies, is red, strewed over with *Flowers de lis*, Gold, and charged with the Arms of *France*.

The Flag of *Provence*, a Province in *France*, is white, with a blue Cross.

That of *Marseilles* in *Provence*, with a *Franc-quarter* of Azure, charged with a Cross Argent.

The Flag of *French* Merchant Ships, is of seven Bends mixed, which are, to begin at the uppermost, one white, and the other blue.

The new Flag of *French* Merchant Ships, is blue, with a Cross Argent, charged *en Cœur*, with the Escutcheon of *France*.

The Flag of *Normandy*, a Province of *France*, is *Mi-partite* of blue and white.

That of *Calais*, a City of *Picardy*, is blue, with a Cross Argent.

That of *Dunkirk*, a City of *French Flanders*, is of six Bends mixed, which are, to begin at the uppermost, one white, and the other blue. — The other Flag of *Dunkirk* is white, with a *Franc-quartier*, charged with a Cross Gules.

Note, That when the *French* Fleets are divided into three Squadrons, and nine Divisions, the first Squadron is that of the Admiral, the other two having each their Vice-Admiral, and each Admiral his Flag; so that the first Squadron is *White*, the second *Blue*, and the third *White* and *Blue*.

The FLAG of the Admiral of *England*, is red charged with an Anchor Argent placed pale-wise, twisted round with a Cable of the same. When the *English* Fleets are divided into three Squadrons, and nine Divisions, each Squadron has its Admiral, and each Admiral his Flag, which gives the Name to the Squadron. So that the Squadron of the first Admiral above blazoned, is called the red Squadron, the others the white Squadron, and the blue Squadron.

The Flag of the *white Squadron* is white, a *Cross Gules* at the Head; and that of the *blue Squadron* is blue, at the Head *Argent* with a *Cross Gules*.

The *particular Flag* of *England*, is blue, at the Head *Argent* with a *Cross Gules*, and the other Corner is charged with a *Saltier*, or *St. Andrew's Cross*.

Another Flag of the Division of a Squadron, is of thirteen Bends, which are alternately to begin at the uppermost, one red, and the other white, at the Head *Argent* charged with a *Cross Gules*.

The *red Flag* of *England*, is red, at the Head, *Argent* charged with a *red Cross*.

The Flag of the People of *England*, is red, bearing in the Middle an Escutcheon Gules, border'd with Silver, and charged with three Leopards Or, which are the Arms of the Kingdom, and on that Side the Flag-Staff, a *Pale Argent* charged with a *Cross Gules*.

The *Flag* of *England*, called of the *Union*, is *Gules* charged with these Words in *English*; FOR THE PROTESTANT RELIGION.

The *new Flag* of the *Union* is blue, at the Head, *Azure* charged at the Head with a *Saltier Argent*, and a *Cross Gules* border'd *Argent*.

The *particular Flag* of *England*, is white with a *Cross Gules* at the Head *Argent*, charged with a *Cross Gules*.

The *new Flag* of the Admiral of *England* is red, charged with an Anchor *Argent*, placed facing, twisted round with a Cable of the same.

The Flag of the Bowspirit of *England*, called *Jack*,

is blue, charged with a *Saltier Argent*, and a *Crofs Gules* border'd *Argent*.

The *Flag* of the *East-India Company* of *England*, is of ten Bends, five red, and five white, at the Head, *Argent* charged with a *red Crofs*.

The *Flag* of *New-England* in *America*, is blue, at the Head *Argent*, quarter'd with a *red Crofs*, having at the first Quarter a celestial Sphere.

The *Flag* of *St. George* is white, charged with a red *Crofs*.

The *Flag* of the *Isle of Man*, is red, charged with three Men's Legs; at the Head *Argent* charged with a red *Crofs*.

The *Flag* of *Scotland* is blue, at the Head *Argent*, with a *Crofs Gules*.

The *red Flag* of *Scotland* is red, at the Head *Argent*, charged with a *Saltier*, or *St. Andrew's Crofs Argent*.

The *Flag* of the *East-India Company* of *Scotland* is red, charged with a Sun Or, which rises, and comes out from behind three Stripes, one whereof is blue, the other white, and the third blue.

The *Flag* of *Division* between *Scotch Ships*, is of eleven Bends, six blue, and five white, at the Head Silver, charged with a red *Crofs*.

The *Flag* of *Ireland* is white, charged with a *St. Andrew's Crofs Gules*.

The *particular Flag* of *Ireland* is green, charged with a Harp Or, at the Head *Argent*, with a *Crofs Gules*.

The *ROYAL FLAG* of *Spain* is of three Bends, one red, the other white, and the third yellow. The Middlemost, which is white, is charged with a Black Eagle, crowned and environed with the Order of the Golden Fleece.

The *Flag* of the *Spanish Galleons* is of three Bends, one red, the other white, and the third yellow. The Middlemost which is white, is charged with a black Eagle, crowned and environed with the Order of the Golden Fleece.

The *particular Flag* of *Spain* is of three Bends, one red, the other yellow, and the third blue.

The *Flag* of *Castile* and *Leon*, Provinces of *Spain*, is white, charged with an Escutcheon quarter'd at the first, and fourth of *Castille*; at the second, and third of *Leon*. Which is also the *Flag* of the *Spanish Galleys* of the first Rank.

The *Flag* of *Barcelona*, a City of *Spain*, in *Catalonia*, is blue, charged with a Monk, cloathed black, holding *Beads* or *Pater-Nosters* in his right Hand.

The *Flag* of *Galicia*, a Province of *Spain*, is white, charged with a Chalice, or a cover'd Cup Or, on both Sides three red *Crosses*.

The *ROYAL FLAG* of *Portugal* is white, charged with the Arms of the Kingdom of *Portugal*, the whole *Flag* being traversed with a *Crofs Sable*, the Head charged with a *Crofs Argent*.

The *military Flag* of *Portugal* is white, charged with an Escutcheon *Gules*, border'd *Argent*, traversed with a *Crofs* of the same, and crowned with a Royal Crown.

The *Flag* of *Portuguese Merchant-Ships*, is of seven Bends mixed, which are, beginning at the Uppermost, one green, and the other white.

The *white Flag* of *Portugal* is white, charged with a celestial Sphere Or, surmounted with a Sphere of the World *Azure*, with a Horizon Or, and a *Crofs Purple* over it. This *Flag*, and the two following, are the *Flags* of the *Portuguese India-Men*.

Another *white Flag* of *Portugal*, is charged with a celestial Sphere purple, with two *Crosses Gules* on the Sides, and one of the same a-top, placed on a Sphere of the World *Azure*, with an Horizon Or, and in the Middle of the celestial Sphere, is another Sphere of the World *Azure*, on a Pillar Or.

Another *Flag* of *Portugal* is white, charged towards the Staff, with the Arms of the Kingdom, and a celestial Sphere purple in the Middle, surmounted with a Sphere of the World *Azure*, with an Horizon Or, and a *Crofs Gules* a-top, supported by a Pillar, Gold, with two Holes Or, on the Sides; and towards the other End there is, on the Side of the Sphere, a Monk dressed in black, holding in his right Hand a *Crofs Gules*, and *Beads* in his left.

The *Flag* of *Oporto*, in *Portugal*, is of eleven Bends

mixed, the six first thereof, to begin at the Uppermost are green, and the five others white.

The *particular Flag* of *Portugal*, is of three Bends, one red, the other white, and the third yellow.

The *FLAG* of *Rome* is white, charged with two Keys Or, placed *Saltier-wise*, and crowned with a *Tyber*, Gold.

Another *Flag* of *Rome* is red, charged with an Angel, *Argent*.

Another *Flag* of *Rome*, charged with the Arms of *Rome*, which are oval-wise, border'd Or, the Escutcheon tierced in *Pale*, of *Gules*, *Azure*, and *Gules*; the *Azure* border'd Or, and charged with four Letters Or, likewise, viz. S. P. Q. R. i. e. *Senatus Populus que Romanus*, The Senate and Roman People.

The *FLAG* of the *Pope* is white, charged with the Images of *St. Peter* and *St. Paul*, that of *St. Peter*, holding in his right Hand two Keys placed *Saltier-wise*, and a Book under his left; and that of *St. Paul* holding a Book in his right Hand, and in his left a Sword.

The *FLAG* of the *Emperor* of *Germany*, was formerly yellow, with an Imperial Eagle displayed, *Sable*, holding in its right Talon a naked Sword, and a Scepter in its left.

The *white Flag* of *Burgundy* is white, charged with a *Crofs Gules*, placed *Saltier-wise*.

The *blue Flag* of *Burgundy* is charged with the same *Crofs* as the white.

The *FLAG* of *Flanders* is of three Bends, one red a-top, the other white in the Middle, and the third yellow, that of the Middle is charged with a *Crofs* of *Burgundy*.

The *Flag* of the *Bowsprit* of *Flanders* is yellow, charged with a *Lyon Sable*, inclosed within an Orle of *Sable*, placed Escutcheon-wise, contained within eight *Flowers de lis Sable*, three a-top, and five round it, surmounted with a Crown *Sable*, with three *Flowers de lis*, likewise, *Sable*.

The *Flag* of *Ostend* in *Flanders*, is mi-parti, red a-top, and yellow at Bottom.

The *FLAG* of *Brabant* is chequered red and white.

The *FLAG* of the *States-General* of the *United Provinces* is red charged with a *Lyon Or*, holding in its right Paw a Sabre *Argent*, and in its left a Bundle of seven Arrows Or, the Points and Pens thereof are *Azure*, which are the Arms of the State.

The *Flag* of the *Bowsprit* of the *States-General* is orange and blue, cut with a *Crofs Argent*, with an Escutcheon of the Arms of the State.

The *Flag* of *Amsterdam* is of three Bends, the Uppermost of which is red, the Middlemost white, and the lowest black. On the middlemost Bend are the Arms of *Amsterdam*, viz. *Gules*, with a *Pale Sable*, charged with three *Saltiers Argent*. An Imperial Crown, and for Supporters two *Lyons Sable*.

The *Flag* of the *East-India Company* is of three Bends like that of the States, but the white or middlemost Bend is charged with these three Letters Cypher-wise, A O C, which signify in *Dutch*, ALGEMEENE OOST-JUDISCHE COMPANIE; and in *English*, The general Company of the East-Indies. This *Flag* is hoisted in all the Ships which are in the Service of the *East-India Company*, except those which are of the Chamber of *Amsterdam*, which have their *Flag* charged with these four Letters Cypher-wise, O. C. V. A. i. e. in *Dutch*, OOST-INDISCHE COMPANIE VAN AMSTERDAM, and in *English*, The East-India Company of Amsterdam.

The *Flag* of the *West-India Company* is of three Bends, like that of the State, with this single Difference, that the white or middlemost Bend is charged with these Letters placed Cypher-wise, G. W. C. i. e. The West-India Company, granted by the States the 10th of June 1621.

The *Flag* of *Hoorn*, a City of *North-Holland*, is of three Bends, two *Reeds*, and a white one in the Middle, on which is a Horn *Gules*.

The *Flag* of *Zeland* is of three Bends, one Orange Colour, the other white, and the third blue, the whole charged with the Arms of *Zeland*.

The *Flag* of *Enchuse* is of thirteen Bends, which are alternately beginning at the Uppermost, one red and the other yellow.

The *Flag* of the *Isle* of the *Texel*, is green and red.

The *Flag* of *Middlebourg*, Capital of *Zeland*, is of

three Bends, one *red*, the second *white*, and the third *yellow*.

The *Jack* of *Middlebourg*, is *red*, charged with a Tower creneled *Or*.

The *Flag* of *Flessingues* in *Zeland*, is *red*, charged with an *Urn argent*, crowned with the same.

The *Flag* of *West-Frizeland*, is *azure*, strewn over with *Billets* leaning *Or*, with two *Leopards* of the same.

The *Flag* of *Rotterdam*, is of twelve Bends, which are to begin at the uppermost, *green* and *white*.

The *Flag* of *Harlinguen*, is *yellow*, bordered with *blue* a-top and at Bottom, and charged in the Middle with an *Escutcheon argent*, bordered *blue*.

The *Flag* of *Hambourg* in *Germany*, is *blue*, charged with a large Tower *argent*.

Another *Flag* of *Hambourg*, is *red*, charged with three Towers *argent*, one and two placed near one another.

Another *Flag* of *Hambourg*, is *red*, charged on the upper Corner with a Tower *sable*.

The *Flag* of *Embsen* in *Westphalia*, is of three Bends, one *yellow*, which is the upper, and the other *red*, and the third *blue*. The upper and lower are pointed in Form of a Flame, and the middle one is round like a Tongue.

Another *Flag* of *Embsen*, is of three Bends, *red*, *yellow* and *red*. The two red Bends are pointed in Form of a Flame, and that of the Middle is waved Inside, and shortened at its End.

The *Flag* of *Nerden*, in the County of *Embsen*, is *blue*, charged with three Stars *argent*.

The *Flag* of *Bremen* in *Lower Saxony*, is of nine Bends, five *red* and four *white*, charged near the Staff with a pale chequered *argent*, and *gules*.

The *Flag* of *Lubeck*, an imperial City, is *mi parti* of two Bends, the upper is *white*, and the lower *red*.

The *Flag* of *Lubeck*, is of two Bends, charged with an Eagle with two Heads, display'd *sable*, holding in its right Talons a blue Sword, and in the left a Sceptre *Or*, crowned with a royal Crown, covered *en cœur*, with an *Escutcheon* cut *argent*, and *gules*.

The *Flag* of *Lunebourg*, is *red*, charged with a flying Horse *Or*.

The *Flag* of *Wismar* in the Dutchy of *Mecklenbourg*, is of six Bends mixed, which are alternately to begin at the uppermost, one *red* and the other *white*.

The *Flag* of *Rostock*, in the Dutchy of *Mecklenbourg*, is *yellow*, charged with a Griffin *gules*.

Another *Flag* of *Rostock*, is of three Bends, the uppermost is *blue*, that of the middle *white*, and the lowest *red*.

The *Flag* of *Stralsund* in *Pomerania*, is *red*, charged with a Sun *Or*.

The *Flag* of *Stetin* in *Pomerania*, is *mi-parti*, the Top is *white*, charged with a Billet *gules*, and the Bottom *red* charged with a Billet *argent*.

The *Flag* of *Brandebourg*, is *white*, charged with a black Eagle, which bears on its left Side an *Escutcheon azure* bordered *argent*, with a Sceptre *Or*.

Another *Flag* of *Brandebourg*, which is like the former, except that the Arms are separated from the Sceptre on the left Side of the Eagle.

The *Flag* of *Brandebourg*, is *white*, charged with an Eagle *gules*, holding in its right Talons a Sword *azure*, with the Hilt *sable*, and in its Left a Sceptre *Or*, crowned and covered with an electoral Cap furred with *Ermines*, surmounted on both Sides with a Cross, and Pearls *Silver*.

Another *Flag* of *Brandebourg*, is *white*, charged with a Pelican *gules*, with two Heads display'd *Or*, crowned with a Marquis's Coronet, holding a Sword in its right Talons, and in its Left a Sceptre.

Another *Flag* of *Brandebourg*, which is of seven Bends, four *white* and three *black*, charged with an *Escutcheon argent*, and an Eagle *gules*.

The *Flag* of *Dantzick*, a City of *Poland*, in the Royal *Prussia*, is *red*, charged near the Staff with two Crosses *argent*, one over the other, the uppermost crowned with the same.

The *Flag* of the *West-India Company* of *Hambourg*, is *white*, charged with an Eagle with two Heads display'd *sable*, holding a Sword in its right Talons, and in its Left a Sceptre *Or*, crowned with a royal Crown.

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The *Flag* of *Koningsberg*, the Capital of the *Ducal Prussia*, is of seven Bends mixed, viz. four *white* and three *blue*, charged with an Eagle display'd *gules*, holding a Sword in each Claw.

Another *Flag* of *Koningsberg*, which is of six Bends mixed *black* and *white*.

The *Flag* of *Memel*, a City of *Ducal Prussia*, is of three Bends, one *yellow* between two *red*.

The *Flag* of the King of *Poland*, is *red* charged with an Arm coming out of a Cloud *azure*, holding a Sword *argent*, with the Hilt *sable*, covered as far as the Elbow with Cloth of *Silver*, with a Ruffle *Or*.

The *Flag* of *Poland*, is *red* charged with an Eagle *argent*.

The *Flag* of *Courland*, is *mi-parti*, the upper Bend i *white*, and the lower *red*.

The *Royal Flag* of *Sweden*, is cleft, and *blue*, with a Gold Cross, the Point whereof, which comes into the Slit, comes out of it in Form of a Tongue.

The *Swedish Flag*, is the same with the *Royal Flag*, except that there is no Sloping in it.

The *Swedish Flag* of *Riga* in *Livonia*, belonging at present to *Muscovy*, is *blue*, with a Cross *Or*, charged *en cœur*, with the Arms of *Riga*, which is *gules* with two Keys *argent* placed in Saltir, between which there is a-top a Cross *Or*.

The *Flag* of *Riga* in *Livonia*, is *white*, charged with a Gate with two Towers *gules*, between which there is a Lion *Or*, and above the Gate are the same Arms, as in the former Flag.

The *Flag* of *Revel* in *Livonia*, is of six Bends mixed with *blue* and *white*; the first a-top is *blue*.

The *Flag* of the King of *Denmark*, is *red* cut with a Cross *argent*, having *en cœur*, a *white* *Escutcheon* charged with a Cypher *sable* of the King's Name, and crowned with a royal Crown.

The *Royal Flag* of *Denmark*, is cleft and *red*, with a Cross *argent*, the Point whereof, which comes from the Slit, comes out of it sloping between the two other red Points.

The *Danish Flag*, is split and traversed with a Cross *argent*.

The *Flag* of *Merchant-Ships* is square.

The *Flag* of *Bergen* and *Norway*, is *red*, traversed with a Cross *argent*, charged *en cœur*, with an *Escutcheon argent*, with a Lion *gules*, holding in its right Paw a Sword *azure*, with a Hilt *sable*, and environed with two Branches of a Tree, with their Leaves Crown-wise.

The *Flag* of *Holstein Sleswick*, is *red*, charged with the Arms of *Sleswick*, which are *Or* charged with two Lions leopardized *azure*, and environed with the Nettle-Leaf of *Holstein*, which is *argent* with two Nails of the same, and crowned.

The *Flag* of *Helgeland*, an Island near *Holstein*, is of eight Bends mixed, which are to begin at the uppermost *blue*, *red*, *white*, and then *blue* and *white*.

The *Flag* of the King of *Sardinia*, as Duke of *Savoy*, is *red* with a Silver Cross, which divides it into four Quarters, in each of which is one of these four Letters, F. E. R. T. i. e. *Fortitudo ejus Rhodum tenuit*, in *English*, *His Valour has saved Rhodes*.

The *Flag* of the Duke of *Modena*, is *blue*, charged with an Eagle display'd *argent*, beaked and membered *Or*.

The *Flag* of *Jerusalem*, in the Holy Land, is *white*, charged with a Cross potent *Or*, cantoned with four Croisettes of the same.

The *Flag* of the Prince of *Monaco*, is *white*, charged with an *Escutcheon* fuleled *argent* and *gules*.

The *Flag* of *Genoa*, is *white*, traversed with a Cross *gules*.

The *Flag* of the Island of *Corfica*, is *white*, charged with a Moor's Head, environed with a white Bender.

The *Flag* of the Great Duke of *Tuscany*, is *white*, charged with the Arms of the Grand Duke, crowned with a Ducal Coronet, a Cross hanging at a blue Ribbon for the Order of St. Stephen.

The *Flag* of *Leghorn* in *Tuscany*, is *white*, charged with a Cross *gules*, the Ends whereof are terminated in Half-Moons, and at each of them there is an Owl.

The *Flag* of the Gallies of *Leghorn*, is *red*, bordered on three Sides with *yellow*, and bearing in the Middle a round *Escutcheon argent*, charged with a Cross of

St

St. Stephen, which is *gules*, and shaped like that of *Malia*.

The Flag of *Ragusa* in *Dalmatia*, on the Coasts of the Gulph of *Venice*, is *white*, charged with an Escutcheon, with the Word *Libertas*.

Another Flag of *Ragusa*, which is *white*, charged with a Monk dressed in Black, having at his Sides these two Letters S. B. i. e. St. Benedict.

The Flag of *Venice*, or of St. Mark, is *red*, charged with a winged Lion Or, placed on a small Bend *azure*, holding in its right Paw a Cross Or, and in its Left a Book, where these Words are written, *Pax tibi MARCE, Evangelista meus*.

Another Flag of *Venice*, which is like the first, except that the Lion holds in its right Paw a Sword *azure*, with the Hilt and Groop *fable*.

The particular Flag of *Venice*, is *red*, charged with the same Lion holding in its two Paws the Book of St. Mark.

The Flag of *Ancona*, a City of *Italy*, is *mi-parti*, the Top *red* and the Bottom *yellow*.

The Flag of *Mantua*, is *blue*, bordered with *red* on the three Sides, on that a-top are written these Words, AL BISOGNO RASSEMBRO, i. e. I join again in case of Need; and on the Side at Bottom, L'HUOMO GIRA IL FATO, i. e. Man will make the Fate change. The Middle of the Flag is charged with a Woman's Head, the hind Part whereof is covered with a black Mask.

The Flag of *Malta*, is *white*, charged with a Cross of *Malta*, *gules*.

Another Flag of *Malta*, which is *red*, with a *white* Cross.

The Flag of the Isle of *Sardinia*, is *white* with a Cross *azure*, which divides it into four Quarters, in each of them is a Moor's Head, incircled with a white Bend.

The Flag of the Island of *Majorca*, is *white* bearing the Arms of that Island, which are quartered at the first and fourth *gules*, charged with three Skins Or; at the second and third *argent*, charged at Bottom with a Beam *gules*, surmounted with another small Beam placed Cross-wise. Behind the Escutcheon there are two Standards passed Saltir-wise, which are *blue*, and both charged with a Tower Or. Under the Escutcheon there are two Canons of *Sinople*, half whereof, which is hid behind the Escutcheon, is also passed Saltir-wise, and at the lower End of the Flag are two Poinards *azure*, garnished Or.

The Flag of *Sicily*, is of six Bends, those at Top and at Bottom are *white*, each charged with an Eagle *fable*, beaked and membered *gules*, the four Bends of the Middle are alternately, one *red* and the other *white*.

The Flag of *Messina*, a City of the Kingdom of *Sicily*, is *white*, charged with an Eagle with two Heads display'd *fable*.

The Flag of the Capitan Galley of *Sicily*, is *white*, charged with an Eagle display'd *fable*.

The Flag of the Two *Sicilies*, is *blue*, charged with an Eagle display'd *argent*.

The Flag of *Naples*, is *white*, charged with a Griffin of *Sinople*.

The Flag of the Empress of *Russia*, is *yellow*, charged with an Eagle *fable*, which are the Arms of the *Russian* Empire. This Eagle is with two Heads, bearing three Crowns, one Imperial, and the other two Royal, charged *en cœur*, with an Escutcheon *argent*, with a St. George *fable* with his Dragon: At its two Heads and Feet it carries four Sea-Charts; the Chart at the right Head represents the *White Sea*, that at the Left the *Caspian Sea*, that held with the right Talon represents the *Pelus Alcotides*, and that with the Left the *Sinus Botanicus*.

The first Flag of *Russia*, is *white*, charged with a St. Andrew's Cross *azure*, to shew that the *Russian* Empire has received the Baptism by the Ministry of that Apostle.

The second Flag of *Russia*, is *blue* with a frank Quarter *argent*, charged with a St. Andrew's Cross *azure*.

The third Flag of *Russia*, is *red* with a frank Quarter *argent*, charged with a St. Andrew's Cross *azure*.

The Gaillard *Russian*, is *red*, charged with a St. Andrew's Cross *azure*, lined with *white*.

The Flags of the *Russian* Gallies, they are like the

preceding, except that they are not square but cleft at the Point.

The Flag of *Russian Merchant-Ships*, is of three Bends, one *white*, the other *azure*, and the third *red*.

The Flag of the *Russian Admiral*, is *white*, charged with four Anchors *azure*, placed in form of St. Andrew's Cross, to signify the four Seas already mentioned.

The Flag of the Emperor of *Tartary*, and of *China*, is *yellow*, charged with a Dragon *fable*, with a Tail of a Basilisk of the same, with five Claws on each Paw, and the Head turned Outside. The Emperor of *China* keeps several whole Fleets to secure the Navigation, makes them carry that Flag, which is so much respected, that all Ships withdraw at its Aspect.

Another Flag of the *Tartars*, which is *yellow*, charged with an Owl *fable*.

The Flag of the Emperor of *China*, is *white*, charged in the Middle with a round Volute, half *red* and half *yellow*; round the Circles of that Volute are eight Characters, in one Half whereof are six Points, and in the other Half four Points in each, with a Dash a-top.

The Flag of the *Junks* of *Nanquin* in *China*, is of four Bends, one *grey*, the other *blue*, the third *red*, and the fourth *white*.

The Flag of the Emperor of *Japan*, is *red*, charged with a Half-Moon Or, and with two blue Swords, waved and garnished Or, placed Saltir-wise.

The Flag of *Batavia* in the *East-Indies*, is *red*, charged with a Sword *argent*, its Point upwards crowned with Laurel; the whole Sword is likewise environed with Crowns of Laurel of *Sinople*, and surmounted with a small Garland of the same.

Another Flag of *Batavia*, which is of six Bends like the double Flag of *Holland*, charged with a Sword with a golden Hilt, environed with a Crown of Laurel of *Sinople*, adorned with Flowers at the four Extremities.

The Flag of the King of *Bantam*, is *red* bordered Or, charged with two Half-Moons, and two Swords *azure* garnished Or, placed Saltir-wise.

The Flag of *Bantam* in the *East-Indies*, is *yellow* charged with two Swords *argent*, with the Hilt Or, placed Saltir-wise.

The Flag of the Great Mogul, is *red*, charged with a Woman who dances naked, and these Words on the upper Border, NOCH NIET HALF GEWONNEN, i. e. There is not yet one Half vanquished.

Another Flag of the Grand Mogul, which is *green* charged with a Half-Moon Or.

The Flag of the Grand Seigneur, is cleft, and *green*, bearing in the Middle an oval Escutcheon of *Sinople*, charged with three Half Moons Or, placed near one another, and the Horns upwards.

Another Flag of the Grand Seigneur, which is of thirteen Bends mixed, which are alternately to begin at the uppermost, one *green* and the other *red*.

The Flag of a *Turkish* *Bashaw*, is cleft, and *blue*, traversed with a Cross Or, covered in the Middle with a round Escutcheon of the same, charged with three Half Moons placed near one another, and the Horns thereof are Outside.

The Flag of the *Sopbi* of *Persia*, is *yellow*, charged with three Half-Moons *argent*, the Horns whereof are Outside.

Another Flag of the *Sopbi* of *Persia*, which is *white*, and charged with three Lions *fable*.

The *blue* Flag of the *Turks*, is charged with three Half-Moons *argent*, the Horns Outside.

The particular Flag of the *Persians*, which inhabit the neighbouring Provinces of the *Mogul*, is of five Bends, the first and fifth are *blue*, charged each with two Flowers Or, and two Half-Moons of the same; the second and fourth are *yellow*, each charged with two Crosses *gules*, and the Bend of the Middle is *green*, and extends in Form of a Tongue; it is charged with a Sword *azure*, with the Hilt Or, and at the End of the Tongue with two Half-Moons Or, between which is a Flower Or.

The *red* Flag of the *Turks*, is charged with three Half-Moons *argent*, the Horns turned Outside.

The *red* Flag of the *Turkish* Gallies, terminates into a Point.

The Flag of *Alexandretta*, or *Scanderoun*, is of eight

Bends, which are, to begin at the Uppermost, *red, white, green, red, green, red, white, green*, and terminates into a Round.

The *Flag of Candia* is of three Bends, *red, white, and red*, and terminates into a Point.

The *Flag of Constantinople* is green, charged with three Half-Moons Or, the Horns outside.

The *Flag of the Greeks* is all black.

The *Flag of Smyrna*, a City of *Turkey*, is of five Bends, which are alternately one *green*, and the other *white*.

The *Flag of Tripoly*, in *Barbary*, is green, charged with three Half Moons Or, the Horns turned towards one another.

Another *Flag of Tripoli*, which is of seven Bends, *red, green, white, red, white, green, red*.

The *Flag of Algiers*, in a Fight, is blue, charged with an Arm coming out of a Cloud *Sable*, holding a Scimitar *Argent*, with the Hilt Or, the Arm is environ'd with a Bend *Sable* above the Elbow, and the End of the Arm with a Ruffle embroider'd Or, in Form of Flames.

The *Flag of Esclavonia*, is *mi-parti*, the Top yellow, and the Bottom red.

The *Flag of Tunis*, in *Barbary*, is of five Bends, *blue, red, green, red, blue*: It is terminated into a Point, and the Bend of the Middle is sloping.

Another *Flag of Tunis*, which is green, and terminates into a Point.

The *Flag of Salle* in *Barbary*, is of three Bends, which terminate into a Point, *yellow, white, and red*, and the *white* which is in the Middle, is charged with three Half-Moon, the Horns outside.

Another *Flag of Salle*, which is red, charged with a Half-Moon Or, both Horns outside.

Another *Flag of Salle*, is green, charged with a Sword with two Blades mounted on a Hilt Or.

The *Flag of Tetuan* in *Barbary*, is of three Bends, one *red*, the other *green*, and the third *red*, and the *green* Bend, which is in the Middle, terminates sloping.

The *Flag of the Corsairs* is *red*, charged in the Middle with an Arm holding a Scimitar *Azure*, with the Hilt Or, and above the Elbow a Bend Or, border'd *Azure*; on the Side of the Staff, an Hour-Glass winged *Azure*; and on the other Side, towards the Top of the *Flag*, with a Death's Head, and two Bones; the whole Or, crowned with Laurel.

The *Flag of the King of Morocco* is red, border'd with red and white Points, charged in the Middle with Scissars open, the Points outwards.

The *Flag of the Moors of Africa*, is of two Bends, that a-top is green and narrow, and that at Bottom red and large.

Note, That these *Flags* serve, not only to distinguish the different Nations at Sea, but likewise the Rank of the Officers who command a Fleet, or a Squadron; for Signals, &c. For,

The ADMIRAL, or Commander in Chief, carries his *Flag* on the Main-Top, or Top of the Main-Mast; which the *French* call *Porter pavillon quarré au grand Mast*.

The VICE-ADMIRAL, carries his on the Fore-Top; and the REAR-ADMIRAL his on the Mizzen-Top, or Top of the Mizzen-Mast.

The Commanders of Squadrons bear their *Flag* on the Mizzen-Mast, when in the Body of a Fleet: And on the Main-Mast when they command a Party. It should be cleft two Thirds of its Height, and terminate in a Point.

The *Flags* bore on the Mizzen, are particularly called *Gallants*.

Note, That these *Flags* thus carried on the Top of the Masts, are very different in Shape from those hoisted at the Poop of the Ship; for they are most commonly more magnificent, and not so wide. The *Flag* hoisted at the Main-Mast of the *French* Admiral, or other Commander of a Fleet, is blue, bearing a Sun Or, in its Glory, with this Motto, *Nec pluribus Impar*. By an Ordinance of *Louis XIV.* a *Flag* Officer is order'd to perish, rather than lower, or strike his *Flag*

before any Officer of another Nation, of equal Rank; though of a superior Strength. All Ships, in general; must lower their *Flags* before the Admiral, Vice Admiral, and Rear Admiral; and those *Flag* Officers must observe the same among themselves, *i. e.* that the Vice Admiral must strike before the Admiral, and the Rear Admiral before the Vice Admiral and Admiral, the Admiral alone being obliged to strike before no Body, not even before the King himself, if he was in another Ship.

The *Flag* is also frequently used in *Signals*, at Sea; which are Signs made by the Admiral or Commander in Chief of a Squadron of Ships, either in the Day, or by Night, whether for Sailing, for Fighting, or for the better Security of the Merchant Ships under their Convoy.

These *Signals* are very numerous and important; being all appointed and determined by Order of the Lord High Admiral, or Lords of the Admiralty; and communicated in the Instructions sent to the Commander of every Ship or Squadron, before their putting out to Sea. Therefore there are *Signals by Day*, *Signals by Night*, *Signals when a Fleet sails in a Fog*, *Signals for calling Officers on Board the Admiral*, *Signals for managing a Sea-Fight*, &c.

Signals by Day. — When a Commander in Chief would have them prepared for Sailing; he first looses his Fore-Top-Sail, and then the whole Fleet are to do the same. When he would have them unmoor, he looses his Main-Top-Sail, and fires a Gun, which in the Royal Navy is to be answer'd by every Flag-Ship. When he would have them weigh, he looses his Fore-Top-Sail, and fires a Gun, and sometimes haws home his Sheets: The Gun is to be answer'd by every Flag-Ship, and every Ship to get to sail as soon as it can. If with the Leeward-Side, the Sternmost Ship is to weigh first. When he would have the Weathermost and Headmost Ships to tack first, he hoists the Union-Flag at the Fore-Top-Mast-Head, and fires a Gun, which each Flag-Ship answers; but if he would have the Sternmost and Leewardmost Ships to tack first, he hoists the Union-Flag at the Mizzen-Top-Mast-Head, and fires a Gun; and when he would have the whole Fleet to tack, he hoists an Union, both on the Fore and Mizzen-Top-Mast-Heads, and fires a Gun. When in bad Weather, he would have them veer, and bring to the other Tack, he hoists a Pennant on the Ensign-Staff, and fires a Gun: And then the Leewardmost and Sternmost Ships are to veer first, and bring on the other Tack, and lie by, or go on with an easy Sail, till he comes a-head; every Flag is to answer with the same *Signal*. — If they are lying by, or sailing by a Wind, and the Admiral would have them bear up and sail before the Wind, he hoists his Ensign, and fires a Gun, which the *Flags* are to answer: And then the Leewardmost Ships are to bear up first, and to give Room for the Weathermost to veer, and sail before the Wind with an easy Sail, till the Admiral comes a-head. But if it should happen, when the Admiral has Occasion to veer and sail before the Wind, that Jacks and Ensigns be abroad, he will hawl down the Jack before he fires the Gun to veer, and keep it down till the Fleet is before the Wind. When they are sailing before the Wind, and he would have them bring to, with the Starboard tacks abroad, he hoists a red Flag at the Flag Staff, on the Mizzen-Top-Mast-Head, and fires a Gun. But if they are to bring to, with the Larboard Tack, he hoists a blue Flag at the same Place, and fires a Gun, and every Ship to answer the Gun. — When any Ship discovers the Land, he is to hoist his Jack and Ensign, and keep it abroad, till the Admiral, or Commander in Chief, answers him, by hoisting his; on Sight of which he is to hawl down his Ensign. — If any discovers Danger he is to tack and bear up from it, and to hang his Jack abroad from the Main-Top-Mast-Cross-Trees, and fire two Guns: But if he should strike or stick fast, then, besides the same *Signal* with his Jack, he is to keep firing, till he sees all the Ships observe him, and endeavours to avoid the Danger. — When any sees a Ship or Ships more than the Fleet, he is to put abroad his Ensign, and there keep it, till the Admiral's is out, and then to lower it, as often as he sees Ships, and stand in with them, that so the Admiral may know where they are, and how many; but if he be at such a Distance, that the Ensign cannot well be

be discover'd, he is then to lay his Head towards the Ship or Ships so descryed, and to brail up his low Sails, and continue hoisting and lowering his Top-Sails, and making a Waft with his Top-Gallant-Sails, till he is perceived by the Admiral. When the Admiral would have the Vice Admiral, or he that commands in the second Post of the Fleet, to send out Ships to chase, he hoists his Flag, striped white and red on the Flag-Staff, at the Fore-Top-Mast-Head, and fires a Gun. — When the Admiral would have any Ship to chase to Windward, he makes a *Signal* for speaking with the Captain, and he hoists a red Flag on the Mizzen-Shrowds, and fires a Gun. But if to chase to Leeward, a blue Flag. And the same *Signal* is made by the Flag, in whose Division that Ship is. When he would have them give over the Chase, he hoists a white Flag on his Flag-Staff, at the Fore-Top-Mast-Head, and fires a Gun; which *Signal* is to be made also by that Flag-Ship, which is nearest the Ship that gives Chase, till the chasing Ship sees the *Signal*. — In Case of springing a Leak, or any other Disaster, that disables their Ship from keeping Company, they are to hawl up their Courses, and fire two Guns. — When any Ship would speak with the Admiral, he must spread an *English* Ensign, from the Head of his Main, or Fore-Top-Mast, downwards on the Shrowds, lowering his Main, or Fore-Top-Sail, and firing Guns, till the Admiral observe him; and if any Ship perceives this, and judges the Admiral does not, that Ship must make the same *Signal*, and make the best of his Way to acquaint the Admiral therewith, who will answer by firing one Gun. — When the Admiral would have the Fleet to prepare to Anchor, he hoists an Ensign, striped red, blue, and white, on the Ensign-Staff, and fires a Gun, and every Flag-Ship makes the same *Signal*. If he would have the Fleet moor, he hoists his Mizzen-Top-Sail, with the Clew-Lines hawled up, and fires a Gun. If he would have the Fleet cut or slip, he looses both his Top-Sails, and fires two Guns; and then the Leeward-Ships are to cut or slip first, to give Room to the Weathermost to come to sail. So if he would have any particular Ship to cut or slip, and to chase to Windward, he makes the *Signal* for speaking with that Ship, hoists a red Flag in the Mizzen-Shrowds, and fires a Gun: But if the Ship is to chase to Leeward, he hoists a blue Flag as before. If he would have the Fleet exercise their small Arms, he hoists a red Flag on the Ensign-Staff, and fires a Gun; but if the great Guns, then he puts up a Pennant over the red Flag.

The *Signals by Night*, to be observed at Anchor, weighing Anchor, and Sailing, are as follow. — When the Admiral would have the Fleet to unmoor, and ride short, he hangs out three Lights, one over another, in the Main-Top-Mast Shrowds, over the constant Light in the Main-Top, and fires two Guns, which are to be answer'd by Flag-Ships: And each private Ship hangs out a Light in the Mizzen-Shrowds.

Note, That all Guns fired for *Signals* in the Night, must be fired on the same Side, that they make no Alteration in the Sound.

When he would have them weigh, he hangs a Light in the Main-Top-Mast Shrowds, and fires a Gun, which must be answer'd by all the Flags, and every private Ship must hang out a Light in his Mizzen-Shrowds. — When he would have them tack, he hoists two Flags on the Ensign Staff, one over another, over the constant Light in his Poop, and fires a Gun, which is to be answer'd by all the Flags; and every private Ship is to hang out a Light extraordinary, which is not to be taken in till the Admiral takes in his. — After the *Signal* is made, the Leewardmost and Sternmost Ships, must tack as fast as they can, and the Sternmost Flag-Ship, after he is about on the other Tack, is to lead the Fleet, and him they are to follow, to avoid running thro' one another in the Dark. — When he is upon a Wind, and would have the Fleet veer, and bring to, on the other Tack, he hoists up one Light at the Mizzen-Peak, and fires three Guns, which is to be answer'd by all the Flag-Ships, and every private Ship must answer, with one Light at the Mizzen-Peak. The Sternmost and Leewardmost Ships are to bear up so soon as the *Signal* is made. — When he would have them, in blowing Weather, to

lie a try, short, or a Hull, or with the Head-Sails braced to the Mast, he will form Lights of equal Height, and fire five Guns, which are to be answer'd by the Flag-Ships, and then every private Ship must shew four Lights: And after this, if he would have them to make sail, he then fires ten Guns, which are to be answer'd by all the Flags; and then the Headmost and Weathermost Ships are to make sail first. — When the Fleet is sailing large, or before the Wind, and the Admiral would have them bring to, and lie by with their Starboard Tacks abroad, he puts out four Lights in the Fore-Shrowds, and fires six Guns; but if the Larboard tacks abroad, he fires eight Guns, which are to be answer'd by the Flag-Ships; and every private Ship must shew four Lights. The Windmost Ship must bring to first. — Whenever the Admiral alters his Course, he fires one Gun (without altering his Lights) which is to be answer'd by all the Flag-Ships. If any Ship has Occasion to lie short, or by, after the Fleet has made Sail, he is to fire one Gun, and shew three Lights in his Mizzen Shrowds. — When any one first discovers Land, or Danger, he is to shew as many Lights as he can, to fire one Gun, and to tack, or bear away from it: And if any one happens to spring a Leak, or any be disabled from keeping Company with the Fleet, he hangs out two Lights of equal Height, and fires Guns till he is relieved by some Ship of the Fleet. — If any one discovers a Fleet, he is to fire Guns, make false Fires, put one Light out on the Main-Top, three on the Poop, to steer after them, and to continue firing of Guns, till the Admiral calls him off, by steering another Course, and firing two or three Guns, for then he must follow the Admiral. — When the Admiral anchors, he fires two Guns, a small Space of Time one from the other, which are to be answer'd by the Flag-Ships; and every private Ship must shew one Light. — If he would have them lower their Yards and Top-Masts, he hoists one Light upon his Ensign-Staff, and fires one Gun; which is to be answer'd by the Flag-Ships; and every private Ship must shew one Light. And when he would have them hoist their Yards and Top-Masts, he puts out two Lights, one under the other, in the Mizzen-Top-Mast Shrowds, and fires one Gun, which is to be answer'd by all the Flag-Ships; and every private Ship must shew one Light in the Mizzen-Shrowds. — If any strange Ship be discover'd coming into the Fleet, the next Ship is to endeavour to speak with her, and bring her to an Anchor, and not suffer her to pass through the Fleet. — And if any one discovers a Fleet, and it blows so hard that he cannot come to give the Admiral timely Notice, he is to hang out a great Number of Lights, and to continue firing Gun after Gun, till the Admiral answers him with one. — When the Admiral would have the Fleet to cut or slip, he hangs out four Lights, one at each Main-Yard-Arm, and at each Fore-Yard-Arm, and fires two Guns, which are to be answer'd by the Flag-Ships, and every private Ship is to shew one Light.

As for the *Signals used when a Fleet sails in a Fog*. — If the Admiral would have them weigh, he fires ten Guns, which every Flag-Ship is to answer. — To make them tack, he fires four Guns, which are to be answer'd by the Flag-Ships, and then the Leewardmost and Sternmost Ships must tack first, and after they are about, to go with the same Sail they tacked with, and not to lie by, expecting the Admiral to come a-head: And this is to avoid the Danger of running through one another in thick Weather.

When the Admiral brings to, and lies with his Head-Sails to the Mast; if with the Starboard tack abroad, he fires six Guns; but if the Larboard tacks he fires eight Guns, which the Flag-Ships must answer. And after this, if he makes sail, he fires ten Guns, which the Flag-ships must answer; and then the Headmost and Weathermost Ships are to make sail first. — If it grows thick and foggy Weather, the Admiral will continue sailing with the same Sail set that he had before it grew foggy, and will fire a Gun every Hour, which the Flag-ships must answer, and the private Ships by firing of Muskets, beating of Drums, and ringing of Bells. But if he be forced to make either more or less sail than he had when the Fog began, he will fire a Gun every half Hour, that the Fleet may discern whether they

they come up with the Admiral, or fall a-stern of him; and the Flag and private Ships are to answer as before. If any one discovers Danger, which he can avoid by tacking and standing from it, he is to make the Signal for tacking in a Fog; but if he should chance to strike, and stick fast, he is to fire Gun after Gun, till he thinks the rest have avoided the Danger.—When the Admiral would have the Fleet to Anchor he fires two Guns, which the Flags are to answer; and after he has been half an Hour at an Anchor, he will fire two Guns more, to be answered by the Flags as before, that all the Fleet may know it.

With respect to SIGNALS, for calling Officers on board the Admiral.—When the Admiral puts aboard an Union Flag in the Mizzen-Shrowds, and fires a Gun, all the Captains are to come on board him: And if, with the same Signal, there be also a Waft made with the Ensign, then the Lieutenant of each Ship is to come on board.—If an Ensign be put aboard in the same Place, all the Masters of the Ships of War are to come on board the Admiral.—If a Standard on the Flag Staff be hoisted at the Mizzen-Top-Mast-Head, and a Gun fired, then all the Flag-Officers are to come on board the Admiral. If the *English* Flags only, then a Standard in the Mizzen-Shrowds, and fire a Gun: If the Flags and Land General Officers, then the Admiral puts on board a Standard at the Mizzen-Top-Mast-Head, and a Pennant at Mizzen-Peck, and fires a Gun.—If a red Flag be hoisted in the Mizzen-Shrowds and a Gun fired, then the Captains of his own Squadron are to come on board the Admiral; and if with the same Signal there be also a Waft with the Ensign, the Lieutenant of each Ship must come on board.—If he hoists a white Flag as before, then the Vice-Admiral, or he that commands in the second Post, and all the Captains of his Squadron, must come on board; and if a Waft, as before, the Lieutenants.—When a Standard is hoisted on the Ensign-Staff, and a Gun fired, the Vice and Rear Admirals must come on board the Admiral's Ship.—When the Admiral would speak with the Captains of his own Division, he will hoist a Pennant on the Mizzen-Peck, and fire a Gun; and if with the Lieutenants a Waft is made with the Ensign, and the same Signal: For whenever he would speak with the Lieutenants of any particular Ship, he makes a Signal for the Captain, and a Waft also with the Ensign.—When the Admiral would have all the Tenders in the Fleet come under his Stern and speak with them, he hoists a yellow and white Flag at the Mizzen-Peck, and fires a Gun: But if he would speak with any particular Ship's Tenders, he make a Signal to speak with the Captain she tends upon, and a Waft with the Jack.—If all the Pinnaces and Barges are to come on board manned and armed, the Signal is a Pennant on the Flag-Staff, hoisted on the Fore-Top-Mast-Head, and a Gun fired; and if he would have them chase any Ship, Vessel, or Boat in View, he hoists the Pennant, and fires two Guns.—The Signal for the Long-boats to come on board him, manned and armed, is the Pennant hoisted on the Flag-Staff, at the Mizzen-Top-Mast-Head, and a Gun fired; and if he would have them chase any Ship, Vessel, or Boat in View, without coming on board him, he hoists a Pennant as aforesaid, and fires two Guns.—When the Admiral would have all the Boats in the Fleet come on board him, manned and armed, he hoists a Pennant on the Flag-Staff, both on the Fore-Top-Mast and Mizzen-Top-Mast-Head, and fires one Gun; but if he would have them chase, he hoists his Pennants as before, and fires two Guns.—When the Admiral would speak with the Vettaller, or his Agent, he puts an *English* Ensign in the Mizzen-Top-Mast-Shrowds; and when with him that has the Charge of the Gunner's Stores, he will spread an Ensign at his Main-Top-Sail-Yard-Arm.

As to SIGNALS, for managing a Sea-Fight.—When the Admiral would have a Fleet form a Line of Battle, one Ship a-head of another, he hoists an Union-Flag at the Mizzen-Peck, and fires a Gun; and every Flag-ship does the like. But when they are to form a Line of Battle one a-breast of another, he hoists a Pennant with a Union Flag, &c.—When he would have the Admiral of the White, or he that commands in the second Post, to tack, and endeavour to gain the Wind of the Enemy,

he spreads a white Flag under the Flag at the Main-Top-Mast-Head, and fires a Gun; and when he would have the Vice-Admiral of the Blue do so, he does the same with a blue Flag. If he would have the Vice-Admiral of the Red do so, he spreads a red Flag from the Cap on the Fore-Top-Mast-Head downwards on the back Stay; if the Vice-Admiral of the Blue, he spreads a blue Flag, &c. and fires a Gun.—If he be to Leeward of the Fleet or any Part of it, and he would have them bear down into his Wake or Grain, he hoists a blue Flag at the Mizzen-Peck, and fires a Gun. If he would be to Leeward of the Enemy and his Fleet, or any Part of it be to Leeward of him; in order to bring these Ships into the Line, he bears down with a blue Flag at the Mizzen-Peck under the Union-Flag (which is the Signal for Battle) and fires a Gun; and then those Ships that are to Leeward of him must endeavour to get into his Wake or Grain, according to their Station in the Line of Battle.—When the Fleet is sailing before the Wind, and he would have him who commands in the second Post, and the Ship of the Starboard Quarter to clap by the Wind, and come to the Starboard-Tack, he hoists a red Flag at the Mizzen-Top-Mast-Head; but a blue one if he would have Ships of the Larboard Quarter to come to the Larboard Tack, with a Gun.—If the Van are to attack first, he spreads the Union-Flag at the Flag-Staff, on the Fore-Top-Mast-Head, and fires a Gun, if the red Flag be not abroad; but if it be, then he lowers the Fore-Top-Sails a little, and the Union-Flag is spread from the Cap of the Fore-Top-Mast downwards; and every Flag-ship does the same.—If the Rear be to attack first, he hoists the Union Flag on the Flag-Staff at the Mizzen-Top-Mast-Head, and fires a Gun, which all the Flag-ships are to answer.—If all the Flag-ships are to come into his Wake or Grain, he hoists a red Flag at his Mizzen-Peck, and fires a Gun; and all the Flag-ships must do the same.—If he would have him that commands in the second Post of his Squadron to make more sail (tho' he himself shorten sail) he hoists a white Flag on the Ensign-Staff. But if he that commands in the third Post be to do so, he hoists a blue Flag, and fires a Gun; and all the Flag-ships must make the same Signal.—Whenever he hoists a red Flag on the Flag-Staff on the Fore-Top-Mast-Head, and fires a Gun, every Ship in the Fleet must use their utmost Endeavours to engage the Enemy, in the Order prescribed them.—When he hoists a white Flag at his Mizzen-Peck, and fires a Gun, then all the Frigates of his Squadron that are not of the Line of Battle, are to come under the Stern.—If the Fleet be sailing by a Wind in the Line of Battle, and the Admiral would have them brace their Head-Sails to the Mast, he hoists up a yellow Flag on the Flag-Staff of the Fore-Top-Mast-Head, and fires a Gun, which the Flag-ships must answer, and then the Ships in the Van must fall first, and stand on. If when this Signal is made, the red Flag at the Fore-Top-Mast-Head be abroad, he spreads the yellow Flag under the red.—If the Fleet being near one another, the Admiral would have all the Ships to tack together, the sooner to be in a Posture to engage the Enemy; he hoists an Union-Flag on the Flag-Staff, at the Fore and Mizzen Top-Mast-Heads, and fires a Gun; and all the Flag-ships are to do the same.—The Fleet being in a Line of Battle, if he would have the Ship that leads the Van, hoist, lower, set, or hawl up any of his Sails, he spreads a yellow Flag under that at his Main-Top-Mast-Head, and fires a Gun, which Signal the Flag-ships are to answer; and then the Admiral will hoist, lower, set, or hawl up the Sail, which he would have the Ships do that lead the Van; which is to be answered by the Flag-ships of the Fleet.—When the Enemy runs, and he would have the whole Fleet follow them, he makes all the Sail he can after them himself, takes down the Signal for the Line of Battle, and fires two Guns out of his Fore-chace, which the Flag ships answer; and then every Ship is to endeavour to come up with, and board the Enemy.—When he would have the Chace given over, he hoists a white Flag at the Fore-Top-Mast-Head, and fires a Gun.—If he would have the red Squadron draw into a Line of Battle, one a-breast of another, he puts abroad a Flag, striped white and red,

on the Flag-Staff, at the Main-Top Mast-Head, with a Pennant under it, and fires a Gun: If the white or second Squadron is to do so, the Flag is striped red, white, and blue: If the blue or third Squadron is to do so, the Flag is a *Genoese* Ensign and Pennant: But if they are to draw into a Line of Battle, one a-head of another, the same Signals are made without a Pennant. If they are to draw into a Line of Battle one a-stern of another with a large Wind, and he would have the Leaders go with the Starboard Tacks aboard by the Wind, he hoists a red and white Flag at the Mizzen-Peck, and fires a Gun: But if he should go with the Larboard Tacks aboard by the Wind, he hoists a *Genoese* Flag at the same Place; which Signals, like others, must be answered by the Flag-ships.—These are *English* Signals.

The *French* Signals are but very little different from them.—When the Commander in Chief would have them prepare for sailing, by Day, he unfurls his Mizzen-Sail, and hoists sometimes a red Flag on the Ensign-Staff, and fires a Gun; then all the Captains must likewise unfurl their Mizzen-Sail to sail with him.—If the Admiral will sail by Night, he puts two Lights at the Stern, and fires a Gun. The other Captains put likewise a Light at the Stern, but takes it off as soon as the Admiral puts on a Third in his Ship.—When the Admiral will come to Anchor at Night, he puts two Lights at the Stern, and one in the Shrowds of the Fore-Mast, and fires a Gun; then all the other Ships put likewise a Light at the Stern, and one in the Shrowds of the Fore-Mast, and takes it in when the Admiral takes in his.—If the Admiral will change his Course, he puts two Lights a little distant from one another at the Stern, or one at the Stern, and the other in the Main-Scuttle, and fires a Gun.—If in the Night it happens some Accident to a Ship of the Fleet all the Lights are put in the Shrowds, and a Gun is fired, then all the other Ships run to its Succour.—If a Ship discovers Land in the Night, or some Place of the Sea where there is but little Water, he puts a Light in the Shrowds of the Fore-Mast, and all the other Ships tack about.—If a Ship discovers the Enemy in Day-time, he puts a red Flag at the Stern, and fires a Gun. If he discovers them in the Night he puts a Light at the Stern, and another in the Main Scuttle, and fires a Gun; then all the other Ships of the Fleet do the same, and chase the Enemy.—If the Admiral discovering the Enemy, judge proper he should be chased, he hoists a Standard at the Main-Top-Mast, and fires a Gun; then the Ships that sail best sail towards the Enemy to fight; if the Admiral will have the Chase given over, he brings down his Standard and fires a Gun.—There are several other *Signals* which are better learned by Experience than by Reading.—As for Pennants and Streamers being at the Heads of Masts, or at the Yard-Arm Ends, they are chiefly used for Shew, though sometimes for Distinction of Squadrons.—The *Flag* or *Ensign*, is also used sometimes in Salutation; though *Salutation* at Sea consists likewise in a Discharge of Cannon, which is greater or lesser according to the Degree or Respect they would shew, and in lowering the Top-Sails, &c.—A *French* Admiral must never lower the royal Flag, but when he passes on the Coasts of a King or State, whose Friendship the King wants to cultivate.—All Ships in general must lower their Flag, before the Admiral, Vice-Admiral, and Rear-Admiral. The last owes that Duty to the second, and this to the first.—When one or several Ships pass before a Citadel, they must salute it by a Discharge of some Cannons, and must do the same when they enter, and come out of a Port.—Ships always salute with an odd Number of Guns, Gallies with an even one.—A Vessel under the Wind of another is always obliged to salute first.—After the Cannon, they sometimes also salute or hale with the Voice, that is, a joint Shout of all the Ship's Company three Times; aboard the *French* Ships with three *Vive le Roy*, and aboard the *English* with three *Huzza's*; which *Salutation* always occasionally obtains where they carry no Guns, or do not care to discharge any.

Saluting with the Flag, is performed two Ways, either by holding it close to the Staff so as it cannot flutter, or by flaking it so as it cannot be seen at all, which is

the most respectful Salutation.

Saluting with the Sails, is performed by lowering the Top-Sails half way of the Masts.—Only those Vessels which carry no Guns salute with the Sails.

When there are several Ships of War together, the Commander alone salutes.

The most powerful Navy in the whole World, for the great Number of Ships and the Goodness of the Wood, is that of *England*; for I cannot imagine it so in all other Respects; for though *England* has a vast Number of excellent Sailors; the great Commerce they carry on to all Parts of the World, in which they are obliged to employ a vast Number of Ships, which cannot sail without Sailors, who are always better pleased to serve the Merchants than the King, because that Service suits best their own Interest, must deprive the Royal Navy of the best Part of its Strength, which must be supplied by a great Number of unexperienced and raw Men, pick'd up in the Streets, and most of them forced on board against their Will. It may be said perhaps, that those Men make up a Number, and that every one of them can fire a Musket as well as the best Sailor, which is not my Sentiment; for most of them being used to an idle, or lazy Life, which is almost always attended with Cowardice, cannot behave as gallantly as those who have been used to it almost all their Life-time; and even suppose that they could fire a Musket as well as another, which I cannot believe, since they have never been used to it; can it be reasonably expected, that they'll behave with as much Courage and Experience, either in boarding the Enemy, or avoiding being boarded by them? That they'll force their Way with Courage into their Ships, or hinder them from forcing into theirs? Whereas a *French* Ship of War has always a full Complement of Sailors, and a certain Number of regular Forces on board, more or less according to the Bigness of the Ship, who make a continual Fire from their small Arms, and know how to do it *apropos*, as having been long exercised to it. There is on board besides these regular Forces, a Detachment of *Guardes de Marine*, who are young Noblemen educated at the King's Expence, in the chief Sea-Ports of the Kingdom, as *Brest*, *Rocheport*, *Dunkirk*, *Toulon*, &c. but particularly *Brest* and *Toulon*; and taught in particular the Art of *Navigation*, to render them capable, in Time, to command the King's Ships; and who are there not only to learn the practical Part of that excellent Art, but likewise to signalize their Valour under the Eyes of their Officers, who are to make their Report of it to the King, that they may be preferred accordingly. Therefore, I ask those who are not infatuated with a ridiculous Notion of I don't know what, if a Ship of any other Nation can fight three such Ships so well mann'd, of equal Force with him; or if such a Thing has ever happened? It is true, that the *French* have not so great a Number of Ships as some other Nations have; but they command more Men, in a very short Time, than any other Nation; neither do I pretend that they are invincible; for History informs me, that they were once soundly beaten by two Fleets confederated, at the *Hogue*; but the same History informs me likewise, that those two Fleets were also soundly beaten by the *French* Fleet alone, off *Beachy Head*, on the Coast of *Sussex*, at *Bantry Bay*, and obliged to retire off *Malaga*; besides several other smaller Engagements, which are convincing Proofs that the *French* are capable to engage any Fleet, Ship to Ship; and that it is a ridiculous Gasconade to speak otherwise; for if I was so unjust to make a general Rule of what has happened sometimes, I could say likewise with as much Appearance of Reason, that a single *French* Man of War can fight, even four Men of War of equal Force with him, of another Nation, since I have been an Eye-witness to it, and those who have read the Memoirs of *Du Gué Trouin*, and have heard of *Du Quisque*, *Jan Bar*, *St. Paul Chateaufrenau*, *de Coetlogon*, my Uncle, &c. Expeditions, know that I speak true.

As for the great Advantages arising from *Navigation*, every body must know that it is the shortest and easiest Way to enrich a Country in a very short Time. For without entering into a Detail of the Commerce of *Portugal*, *Genoa*, &c. which without *Navigation* had been unprofitable

bitable Defarts, for the Sterility of the Soil; without mentioning the immense Riches, which the *Spaniards* import daily from *America* by means of their Fleets; we are only to look on the River *Thames*, covered with a Forest of Ships, continually sailing to, or returning from all Parts of the World, loaded with the best and richest Commodities of both Hemispheres, which renders the *English* Nation one of the most flourishing of the whole Earth; then turning our Eyes towards our Neighbours the *Dutch*, we'll find there a powerful People, risen from nothing, by means of the *Navigation*; for their Oppulence cannot be attributed to the Fertility of their Country, which cannot even produce Food enough for the Subsistence of the Inhabitants, who are obliged to fetch them from other Places. It is therefore nothing else but their Commerce which gluts them with Riches, and renders them formidable to the most powerful Princes of *Europe*. It is the Dexterity and great Experience they have at Sea, which renders them so powerful in the *East Indies*, and intire Masters of the Commerce of Spices.

The Conveniency of transporting a great Quantity of Merchandizes, with a greater Facility, less Expence, and in a short Time, is not the less considerable Profit, arising from *Navigation*, and without taking Notice, of the Impossibility, sometimes, of transporting those great Loads by Land, I'll shew that they costs fifty Times more by Land than by Sea; and take much more Time.

1. For the Expence; we know that a Ship of four hundred Tons carries 800,000 *lb.* Burthen; and that her whole Complement of Men cost most commonly every Month about 160 *l.* Expence, and Freights; and if those same Merchandizes were carried by Land, a Cart drawn by four Horses could not carry more than 1000 *lb.* weight; and therefore there should be wanted 800 Carts, 3000 Horses, and at least 8000 Carmen, besides the Leaders, which would cost very near 300 *lb.* per Diem, fifty Times more.

With Respect to the Time.—We know by a daily Experience, that a Ship well equipped runs often forty Leagues, every Day one with another, *i. e.* in twenty-four Hours, provided the Wind be not contrary. It is true that it makes sometimes but 20 Leagues a Day; but in Requital, it sometimes runs 60 Leagues, and even more in 24 Hours, when it has the Wind very favourable. And we observed that a Cart drawn by four Horses, and loaded with 1000 Weight, can scarce make regularly 30 Miles a Day in very good Roads; and the Horses could never bear the Fatigue if they were forced to travel 150 Leagues in 15 Days; while a Ship will sail 600 Leagues, in that Time, without being the least damaged thereby, provided there happens no Tempest.

The Satisfaction of seeing a hundred different Countries, and an infinite Number of very curious Things and Rarities, is not one of the least Advantages we are indebted for to the Art of *Navigation*.

If it be objected that one runs several very great Dangers on the Sea; I'll answer that they are as great, and no less frequent on Land, where we see daily so many new Misfortunes happen. If it be urged further, that one may lose all he has at once; I'll answer that he may likewise make his Fortune at once.

Note, that what is called the *Art of English Navigation*, is a Statute whereby the Parliament of *England* have settled divers Matters relating to the *Navigation* and Commerce of the Kingdom. 'Till this Act all Nations were at Liberty to import into *England* all Kinds of Merchandizes, either of their own Growth, or laden elsewhere, and that on their own Vessels. *Cromwell* first perceiving the Prejudice this Liberty did to the *English* Commerce, which was now almost wholly in the Hands of Foreigners, chiefly the *Dutch*, whom he hated, animated the *English* by several Acts of Parliament to resume the Trade into their own Hands; and particularly passed an Act, prohibiting the *Dutch* from importing any Merchandizes, except those of their own Growth or Manufacture, which were very few. Upon the Restoration, the first Parliament *Charles II.* called, distinguishing in *Cromwell* the Politician from the Parricide, condemned the Memory of the one, and followed the Plan of the other

with Regard to *Navigation* and Commerce, by passing that celebrated Bill or Act, for the encouraging and increasing of Shipping, and of *Navigation*, which still subsists in its full Latitude, and its ancient Vigour. Its Date is from the first of *December* 1660, 12 *Carol. II.* c. 18. Its chief Articles follow, 1. That no Goods or Commodities shall be imported or exported to or from any of the *English* Colonies in *Asia*, *Africa*, or *America*, but on Vessels built within the Dominions of *England*, or really belonging to *Englishmen*, and whose Masters, and at least three Fourths of the Crew are *English* (*viz.* the King's Subjects of *England*, *Ireland*, and the Plantations; as was explained in a subsequent Act, 13 and 14 *Car. II.* c. 2.) on Pain of Forfeiture of the Goods and Vessels.

2. That no Person out of the Subjection of *England*, or not naturalized, shall exercise any Commerce in those Colonies for himself or others.

3. That no Merchandizes of the Growth of *Asia*, or *America*, shall be imported into any of the Dominions of *England* on any other than *English* Vessels.

4. That no Goods of Foreign Growth, or Manufacture, that shall be brought into *England*, *Wales*, *Ireland*, Islands of *Jersey* or *Guernsey*, or Town of *Berwick on Tweed*, in *English* built Shipping, or other Shipping belonging to the aforesaid Places, and navigated by *English* Mariners as aforesaid, shall be shipped or brought from any other Place or Country, but only from those of the Growth or Manufacture thereof.

5. That all Kind of dried and salted Sea Fish, Train Oil, Blubber, and Whale-fins, not caught by *English* Vessels, imported into *England*, shall pay double Duties.

6. That the Commerce from Port to Port in *England* and *Ireland* shall be carried on only by *English* Vessels, and *English* Merchants; the Crew to be always three Fourths *English*.

7. That none but *English* Vessels shall reap the Benefit of the Diminutions made, or Abatements to be henceforth made in the Customs.

8. All Vessels are prohibited importing into *England* and *Ireland* any of the Commodities of *Muscovy*, or even any Masts, or other Timber, Foreign Salt, Pitch, Rosin, Hemp, Raisins, Prunes, Oil of Olive, any Kind of Corn, or Grain, Sugars, Ashes, and Soap, Wine, Brandy, or Vinegar, except Vessels, whereof *English* are Owners or Part Owners, and where the Master and the Fourth of the Mariners are *English*. And that no Currants, or other Commodities, the Growth or Manufacture of the *Turkish* Empire, shall be imported but in Vessels *English* built, and navigated as aforesaid; except only such Vessels as are of the Building of the Country or Place whereof such Commodities are the Growth or Manufacture, or of such Part where such Goods are usually shipped for Transportation, and unless the Master and three Fourths of the Crew be Natives of the Country where they are laden.

9. All Timber, Masts, Boards, Salt, Pitch, Tar, Rosin, Hemp, Flax, Raisins, Figs, Prunes, Olive Oils, Corn, or Grain of any Kind, Sugar, Pot-Ashes, Brandies, and Wines, and all Goods of the Growth and Manufacture of *Muscovy*, all Currants, and *Turkish* Goods, imported into *England*, &c. in other than such Shipping, and so navigated, shall be deemed Aliens Goods, and pay accordingly.

10. That to prevent Frauds in buying and disguising foreign Vessels, the Proprietors shall take an Oath, that they really belong to them, and that no Alien has any Part in them.

11. That *English* Vessels, and navigated by *English*, may import into the Dominions of *England*, any Merchandizes of the *Levant*, though not taken up in the Places where they grow, or are manufactured; provided it be in some Part of the *Mediterranean*, beyond the Straights of *Gibraltar*. And the same is understood of Commodities brought from the *East Indies*; provided they be taken up in some Port beyond the Cape of *Good Hope*; and those from the *Canaries*, and other Colonies of *Spain*; and the *Azores*, and other Colonies of *Portugal*, which are allowed to be shipped,

ped, the one in *Spanish* Ports, the other in *Portuguese*.

12. These Penalties, Prohibitions, and Confiscations, not to extend to any Goods taken by Way of Reprisal from the Enemies of *England*, nor to Fish caught by the *Scots*, or their Corn, and Salt, which may be imported into *England* by the *Scotch* built Ships.

13. Five Shillings *per* Ton Duty is imposed on every *French* Vessel, arriving in any Part of *England*; so long (and even three Months longer) as 50 Sols *per* Ton, lies on the *English* Vessels in *France*.

Lastly, that Sugar, Tobacco, and other Commodities of the Growth of the *English* Colonies, shall not be imported into any other Part of *Europe*, but the Dominions of *England*. And that Vessels going out of the Ports of the same Crown for the *English* Colonies, shall give 1000 *l.* Security, if under 100 Tons, and 2000 *l.* if above, ere they depart, that they will import their Cargo into some Port in the said Dominions; and the like, ere they quit those Colonies, that they will land their whole Cargo in *England*.

The Poets refer the Invention of the Art of *Navigation* to *Neptune*, some to *Bacchus*, others to *Hercules*, others to *Jason*, others to *Janus*, who is said to have made the first Ship.

Historians ascribe it to the *Æginetes*, the *Phœnicians*, *Tyrians*, and the antient Inhabitants of *Britain*. Some will have it, the first Hint was taken from the Flight of the Kite; others, as *Apian*, *De piscibus*, *Lib. 1.* from the Fish *Nautilus*: Others ascribe it to Accident.

Scripture refer the Origin of so useful an Invention to God himself, who gave the first Specimen thereof in the Ark built by *Noah* under his Direction. For the Raillery the good Man underwent on Account of his Enterprize shews evidently enough, the World was then ignorant of any Thing like *Navigation*, and that they even thought it impossible.

However, History represents the *Phœnicians*, especially those of their Capital *Tyre*, as the first Navigators; being urged to seek a foreign Commerce by the Narrowness and Poverty of a Slip of Ground, they possessed along the Coasts; as well as by the Conveniency of two or three good Ports; and by their natural Genius to Traffick.

Accordingly *Lebanon*, and the other neighbouring Mountains, furnishing them with excellent Wood for Ship-building, in a short Time they were Masters of a numerous Fleet, which constantly hazarding new *Navigations*, and settling new Trades, they soon arrived at an incredible Pitch of Opulency and Populoufness; in as much as to be in a Condition to send out Colonies; the principal of which was that of *Carthage*, which keeping up their *Phœnician* Spirit of Commerce, in Time not only equalled *Tyre* itself, but vastly surpassed it; sending its Merchant Fleets through *Hercules's* Pillars, now the Straights of *Gibraltar*, along the western Coasts of *Africa* and *Europe*; and even, if we believe some Authors, to *America* itself; the Discovery whereof so many Ages afterwards, has been so glorious to the *Spaniards*.

Tyre, whose immense Riches and Power, are represented in such lofty Terms, both in sacred and profane Authors, being destroyed by *Alexander the Great*; its *Navigation*, and Commerce, were transferred by the Conqueror to *Alexandria*, a new City, admirably situated for those Purposes, proposed for the Capital of the Empire of *Asia*, which *Alexander* then meditated. — And thus arose the *Navigation* of the *Egyptians*, which was afterwards so cultivated by the *Ptolemys*, that *Tyre* and *Carthage* (which last, after having a long Time disputed the Empire with the *Romans*, was at length subdued) were quite forgot.

Egypt being reduced into a *Roman* Province, after the Battle of *Actium*, its Trade and *Navigation* fell into the Hands of *Augustus*; in whose Time *Alexandria* was only inferior to *Rome*: And the Magazines of the Capital of the World were wholly supplied with Merchandizes from the Capital of *Egypt*.

At length *Alexandria* itself underwent the Fate of *Tyre* and *Carthage*; being surprized by the *Saracens*, who, in Spite of the Emperor *Heraclius*, overspread the northern Coasts of *Africa*, &c. whence the Merchants being driven, *Alexandria* has ever since been in a languishing State, though still it has a considerable Part of the Commerce of the *Christian* Merchants, trading to the *Levant*.

The Fall of *Rome*, and its Empire, drew along with it, not only that of Learning, and the polite Arts, but that of *Navigation*: The *Barbarians*, into whose Hands it fell, contenting themselves with the Spoils of the Industry of their Predecessors.

But no sooner were the more brave among those Nations well settled in their new Provinces, some in *Gaul*, as the *Franks*; others in *Spain*, as the *Goths*; and others in *Italy*, as the *Lombards*; but they began to learn the Advantage of *Navigation* and Commerce, and the Method of managing them, from the People they subdued; and this with so much Success, that in a little Time some of them became able to give new Lessons, and set on Foot new Institutions for its Advantage.

Thus it is to the *Lombards* we usually ascribe the Invention, and Use of Banks, Book-Keeping, Exchanges, Rechanges, &c.

It does not appear which of the *European* People, after the Settlement of their new Masters, first took themselves to *Navigation* and Commerce. Some think it began with the *French*; tho' the *English* believe, that the *Italians* have the most just Title; and attribute the Glory thereof particularly to those of *Venice* and *Genoa*; it is very true, that it is to their advantageous Situation for *Navigation*, they in great Measure owe their Glory.

In the Bottom of the *Adriatick* were a great Number of marshy Islands, only separated by narrow Channels, but those well skreen'd, and almost inaccessible, the Residence of some Fishermen, who here supported themselves by a little Trade of Fish and Salt, which they found in some of those Islands. Thither then, the *Veneti*, a People inhabiting that Part of *Italy*, along the Coasts of the Gulph, retired, when *Alarick* King of the *Goths*, and afterwards *Attila* King of the *Huns*, ravaged *Italy*.

These new Islanders, little imagining that this was to be their fixed Residence, did not think of composing any Body Politick, but each of the seventy-two Islands of this little *Archipelago*, continued a long Time under its several Masters, and each made a distinct Commonwealth. — When their Commerce was become considerable enough to give Jealousy to their Neighbours, they began to think of uniting into a Body: And it was this Union first begun in the sixth Century, but not completed till the eighth, that laid the sure Foundation of the future Grandeur of the State of *Venice*.

From the Time of this Union, their Fleets of Merchant-Men were sent to all the Parts of the *Mediterranean*; and at last to those of *Egypt*, particularly *Cairo*, a new City built by the *Saracen* Princes on the Eastern Banks of the *Nile*, where they traded for their Spices, and other Products of the *Indies*.

Thus they flourished, increased their Commerce, their *Navigation*, and their Conquests on the *Terra Firma*, till the famous League of *Cambray*, in 1518, when a Number of jealous Princes conspired to their Ruin; which was the more easily effected by the Diminution of their *East-India* Commerce, of which the *Portuguese* had got one Part, and the *French* another.

Genoa, which had applied itself to *Navigation* at the same Time with *Venice*, and that with equal Success, was a long Time its dangerous Rival, disputed with it the Empire of the Sea, and shared with it the Trade of *Egypt*, and other Parts both of the East and West.

Jealousy soon began to break out, and the two Republicks coming to Blows, it was three Centuries almost continual War, ere the Superiority was ascertained; when towards the End of the fourteenth Century, the fatal Battle of *Chiozza* ended the noble Strife: The *Genoese*, who till then had usually the Advantage, having now lost all, and the *Venetians* almost become desperate, at one happy Blow, beyond all Expectation, secured to themselves the Empire of the Sea, and Superiority in Commerce.

About the same Time that *Navigation* was retrieved in the southern Parts of *Europe*, a new Society of Merchants was formed in the North, which not only carried Commerce to the greatest Perfection it was capable of till the Discovery of the *East* and *West-Indies*, but also formed a new Scheme of Laws for the Regulation thereof, which still remain under the Name of *Use and Customs of the Sea*. This Society is the famous League of the *Hanse*.

Hanse Towns, commonly supposed to have begun about the Year 1164. Others say in 1260, immediately after the Incursions and Piracies of the *Danes*, *Normans*, &c. others in 1206, and others in 920; but be its Origin when it will, it was confirmed and re-established in 1270.

Note, That the Word *Hanse* is obsolete *High Dutch*, or *Teutonic*, and signifies *Alliance*, *Confederacy*, *Association*, &c. some derive it from the two German Words *Am-See*, i. e. on the Sea, by Reason the first *Hanse Towns* were all situated on the Sea-Coasts: Whence the Society is said to have been first called *Am-Zee-Steden*, i. e. Cities on the Sea; and afterwards by Abbreviation, *Hanse*, or *Hanse*.

At first it only consisted, as already observed, of Towns situated on the Coast of the *Baltick Sea*, or not far from it. But its Strength and Reputation increasing, scarce any Trading-City in *Europe*, but desired to be admitted into it.

France furnished to the Confederacy, *Rouen*, *St. Malo*, *Bordeaux*, *Bayonne*, and *Marseilles*. — *Spain*, *Barcelona*, *Jecille*, and *Cadiz*. — *England*, *London*. — *Portugal*, *Lisbon*. — The *Low Countries*, *Antwerp*, *Dort*, *Amsterdam*, *Bruges*, *Rotterdam*, *Ostend* and *Dunkirk*. — And *Italy* and *Sicily*, *Messina*, *Leghorn*, and *Naples*.

The *Hanse* was divided into four Classes or Members, which are those of *Lubeck*, *Cologne*, *Brunswick*, and *Prussia*, or *Danzick*. Those four Cities were the Heads of the four Members; and *Lubeck* that of the whole *Hanse*.

Besides this, the *Hanse* had four principal Factories, or Staples; at *London*, *Bruges*, *Novogrod*, and *Berg*; that of *Bruges* was afterwards removed to *Antwerp*. But the first and principal was that of *Lubeck*, which still remains the Head of the Association.

This Society made the third Kind of maritime *Uses*, or *Regulations* at *Lubeck*, about the Year 1597; which *Uses* or *Customs of the Sea*, are certain maritime *Rules* or *Usages*, which make the Base or Ground-work of the maritime Juris-prudence, by which the Policy of *Navigation*, and Commerce of the Sea, are regulated.

These *Uses* and *Customs* consist in two Kinds of *Regulations*, besides that above-mentioned, which makes the third.

The first, called *Laws* or *Judgments of Oleron*, were made by Order of Queen *Eleanor*, Dutches of *Guienne*, at her Return from the Holy War; and that chiefly from Memoirs which she had gathered, in the *Levant*, where Commerce was at that Time in a very flourishing Condition. She called them *Rolls of Oleron*, by Reason she then resided in an Island of that Name in the Bay of *Aquitain*. — They were much augmented about the Year 1266, by her Son *Richard*, King of *England*, on his Return from the *Holy Land*.

The second Regulations were made by the Merchants of *Wisbuy*, a City in the Island of *Gothland*, in the *Baltick*, antiently much famed for Commerce, most of the Nations of *Europe* having their Quarters, Magazines, and Shops therein.

These were compiled in the *Teutonic* Language, and are still the Rules in the northern Countries. Their Date does not appear; but it is probable they were made since the Year 1288, that the City of *Wisbuy* was destroyed the first Time, and afterwards restored by *Magnus* King of *Sweden*.

I'll conclude this Treatise by observing, that the Relation between Commerce and *Navigation*, or if we may be allowed to say it, their Union is so intimate, that the Fall of the one inevitably draws the other after it; and that they will always either flourish or dwindle together; of which all the most powerful Nations are so well convinced, that they endeavour to rival each other in that excellent Art, and are jealous when any of them makes greater Improvements in it than the rest. The late King of *France*, *Louis XIV.* who during his long Reign, encouraged all Arts and Sciences, and promoted with a Liberality worthy of so great a Prince, all the curious Researches and new Discoveries which could be made in either, seem'd to take a particular Care of this, for he not only encouraged building of a vast Number of Ships, to carry the *French* Commerce to the furthest Extremities under both Hemispheres, but to make it flourish, he sent, and received Embassies from the Eastern Princes, concluded Treaties with them, sent learned Men into their Dominions to make new Discoveries, and render the *Navigation* on those Coasts more easy and safe, which judicious Maxims are followed by his Successor, the present King *Louis XV.*

NEEDLE-MAKING.

BEFORE I proceed to instruct our Pupil *Needle-Maker*, how to make *Needles*, I must inform him what a *Needle* is, and how many Sorts of *Needles*.

A *Needle* is a very familiar little Instrument, or Utensil, made of Steel, pointed at one End, and pierced at the other; used in Sewing, Tapestry-Work, &c.

There are several Sorts of *Needles*, viz. *Common Needles*, *Chirurgeons Needles*, *Magnetical Needles*.

The *Common Needles* are quite strait. — The *Chirurgeons Needles* are crooked, and their Points triangular. They are of different Sizes, and bear different Names according to the Purposes they are used for.

The largest are *Needles of Emputation*; the next *Needles for Wounds*; the finest *Needles for Sutures*. — They have others very short and flat for Tendons; others, still shorter, and the Eye placed in the Middle, for the tying together of Vessels.

The best *Needles* are made of *German* and *Hungary* Steel.

The first Thing to be done, in the Manufacture of *Needles*, is to pass the Steel through a Coal-Fire, and under a Hammer to bring it out of its square Figure, into a cylindrical one. This done, it is drawn through a large Hole of a Wire-Drawing Iron; returned into the Fire, and drawn through a second Hole of the Iron, smaller than the first: And thus successively from Hole to Hole, till it have acquired the Degree of Fineness, required for that Species of *Needles*; observing every Time it is to be drawn, that it be greas'd over with Lard, to render it the more manageable.

The Steel thus reduced into a fine Wire, is cut in

Pieces of the Length of the *Needles* intended. These Pieces are flatted at one End on the Anvil, in order to form the Head and Eye.

They are then put in the Fire to soften them further, and thence taken out, and pierced at each Extremity of the flat Part, on the Anvil, by Force of a Puncheon of well temper'd Steel, and laid on a leaden Block, to bring out with another Puncheon, the little Piece of Steel remaining in the Eye.

The Corners are then filed off the Square of the Heads, and a little Cavity filed on each Side the Flat of the Head. This done the Point is formed with a File; and the whole filed over.

They are then laid to heat red-hot, on a long, flat, narrow Iron, crooked at one End in a Charcoal-Fire; and when taken out thence, are thrown into a Basin of cold Water to harden. — On this Operation a good deal depends; too much Heat burns them; and too little leaves them soft; the Medium is only to be learn'd by Experience.

When harden'd, they are laid in an Iron-Shovel, on a Fire more or less brisk, in Proportion to the Thickness of the *Needles*; taking Care to move them from Time to Time. This serves to temper them, and take off their Brittleness; Care, here too, must be taken of the Degree of Heat.

They are then straiten'd one after another with the Hammer; the Coldness of the Water used in hardening them, having twisted the greatest Part of them.

The next Process is the Polishing. — To do this, they take 12 or 15000 *Needles*, and range them in little Heaps against

against each other on a Piece of new Buckram, sprinkled with Emery Dust. The *Needles* thus disposed, Emery Dust is thrown over them, which is again sprinkled with Oil of Olives. At last the whole is made up into a Roll, well bound at both Ends.

This Roll is then laid on a polishing Table, and over it a thick Plank loaden with Stones, which two Men work backwards and forwards, a Day and a half, or two Days successively. By which Means, the Roll thus continually agitated by the Weight and Motion of the Plank over it, the *Needles* within Side being rubbed against each other with Oil and Emery, are insensibly polished.

In *Germany*, instead of Hands they polish with Water Mills, after polishing, they are taken out, and the Filth washed off them with hot Water and Soap: Then wiped in hot Bran, a little moistened, placed with the *Needles* in a round Box, suspended in the Air by a Cord, which is kept stirring, till the Bran and the *Needles* be dry.

The *Needles* thus wiped in two or three different Brans, are taken out, and put in wooden Vessels, to have the good separated from those whose Points or Eyes have been broken, either in polishing or wiping; the Points are, then, all turn'd the same Way, and smoothed with an Emery Stone, turn'd with a Wheel.

This Operation finishes them; and there remains nothing but to make them into Packets of two hundred and fifty each.

Needles make a very considerable Article in Commerce, and the Consumption thereof is almost incredible. The Sizes are from N^o 1. the largest; to N^o 25. the smallest.

Magnetical Needle, is a *Needle* touched with a Load-stone, and sustained on a Pivot or Center, on which playing at Liberty, it directs itself to certain Points, or under the Horizon.

Magnetical Needles are of two Kinds, viz. *Horizontal* and *Inclinatory*.

Horizontal Needles are those equally ballanced on each Side the Pivot which sustains them; and which playing horizontally, with their two Extreams, point out the North and South Points of the Horizon.

To make an *Horizontal Needle*, a Piece of pure Steel is provided, of a Length not exceeding six Inches, lest its Weight impede its Volubility; very thin to take its Verticity the better; not pierced with any Holes, or the like, for Ornament Sake, which prevent the equable Diffusion of the magnetick Virtue.

A Perforation is then made in the Middle of its Length, and a Brass Cap or Head solder'd on, whose inner Cavity is conical, so as to play freely on a Style or Pivot, headed with a fine Steel Point.

The North Point of the *Needle*, in our Hemisphere, is made a little lighter than the Southern, the Touch always destroying the Ballance, if well adjusted before; and rendering the North End heavier than the South, and thus occasioning the *Needle* to dip.

Now to give the *Needle* its Verticity, or directive Faculty, it is to be rubbed leisurely on each Pole of a Magnet, from the South Pole towards the North; first beginning with the northern End; and going back at each repeated Rub, towards the South. — A Rub in a contrary Direction, takes away the Power communicated by the former.

If after Touching, the *Needle* be out of its Equilibrium, something must be filed off from the heavy Side, till it ballance evenly.

A *Needle*, on Occasion, may be prepar'd, without touching it on a Load-stone: For a fine Steel *Needle*, gently laid on the Water, or delicately suspended in the Air, will direct itself to the North and South.

Thus also a *Needle* heated in the Fire, and cooled again in the Direction of the Meridian, or even only in an erect Situation, acquires the same Faculty.

N O B I L I T Y.

NO B I L I T Y, is a Quality which should suppose in the Person dignified therewith, some extraordinary Merit or Virtue; since it raises him above the rest of Mankind.

I say that *Nobility* should suppose in the Person honoured with that distinguishing Quality, an extraordinary Merit or Virtue; because, tho' *Nobility* in its first Institution, was consider'd as a Reward due to Merit and Virtue, it has been in Process of Time, so scandalously prodigalized, and the Intention of the first Institutors thereof so perfidiously and unjustly frustrated; that in some corrupted Ages, and under effeminate and avacious Princes, where human Reason was as much depraved, as Manners were corrupted, none but unworthy Wretches seem'd to have a just Claim to it; and Virtue, Piety, Courage, Probity, Disinterestedness, and Wisdom, to be a Bar to *Nobility*.

It is true, that *Nobility* was not thought by the Creator, as a Quality inseparable from a human Creature, and so absolutely necessary to us, that we could not be considered as the most perfect Workmanship that come out of his divine Hands without it. In the World's Infancy, all Men were equal; and there was no other Distinction among them, than that of Age; for *Adam* was no more a Nobleman, than his first Descendants; but in Process of Time, the human Race having multiplied prodigiously, and that Equality which had subsisted among them, while they were but few in Number, becoming impugned; it was thought proper, to prevent the great Disorders it was likely to be attended with, if it continued longer, to establish a certain Subordination, founded on the Difference of Conditions; but as Men could never have been persuaded to obey, and suffer themselves to be govern'd by other Men like them, unless they could see something in those Men, which claim'd such a Respect; and they could not find it themselves, none were rais'd to a superior Rank, till after

they had signalized, in a particular Manner, and on several great Occasions, some rare Quality, peculiar to themselves, and which had gain'd the publick Applause. In those former Ages, not yet so much corrupted as those which have followed, it was not the Rank which claimed the Respect and Submission of the Inferiors, but it was the Respect and Submission of the Inferiors, gain'd by Merit, and the continual Practice of Virtue, which bestow'd the Rank or Quality; and Noblemen, then, had no other Patents, than an universal Approbation of their personal Merit.

This just and judicious Method of creating Noblemen, continued long in the same State. A Person who had behaved gallantly in the Field, and had often expos'd his Life in Defence of his Country; one who had contributed much to the Welfare of the Commonwealth; he who had made some new Discoveries in some Arts or Sciences of a publick Use, or had made them flourish, by an assiduous Study and continual Labour, wanted no other Title of *Nobility*, and no other Patron to promote his Advancement.

It is not to be supposed, that in former Ages, a Title thus obtain'd was hereditary in Families, for as it was given to nothing else but Merit, and Merit was personal, I am apt enough to believe, that at the Person's Death, the Merit ceasing, the Title was also extinct; and if his Posterity wanted it, they were oblig'd to have Recourse to the same Means he had us'd to observe it; therefore an unworthy Son had not the least Claim to the Honour acquired by a worthy Father.

In Process of Time, Men's Minds altered in this, as in all other Things; and were of Opinion, that to perpetuate the Memory of a great Man, and to render the Posterity sensible of the Gratitude of the Age he had liv'd in, they could do no less, than render his Honour and Titles hereditary, as well as his Estate; imagining, perhaps, that it was almost impossible, that so sound, and so noble

ble a Stock, should shoot forth spurious Branches. But if they thought so, they were grossly mistaken, for if such Disorder did not happen in their Time, we have seen, since, that the purest and most illustrious Blood, has been much, if not entirely corrupted, in the several different spurious Veins it has run through; that Noblemen, who had Heroes for their Ancestors, were themselves the greatest Poltroons; that the Sons of Fathers, who had spent their whole Life in the Service of the Commonwealth, and died with the glorious Name of true Patriots, have either neglected that Service, to live in Luxury and Indolence; or set its Welfare to Auction, and sold it to the best Bidder. That Parents, distinguished for their Wisdom and profound Knowledge, have left Children who gloried in their Stupidity and Ignorance.

But the worst is, that Princes who have attributed to themselves the Power of making whom they please noble, have but too often less Regard to Merit, than to any other Consideration, and rank among the Nobility, those who would be a Disgrace to the lowest Rank of Mankind; and who seem'd to be placed above the rest, with no other View than to render their Unworthiness more conspicuous, and shew the Want of Discernment, or perhaps something worse, in those who have placed them.

What shall I say of those who render Marks of Distinction a venal Commodity, make an infamous Commerce, of what is due to Merit only, and sell for ready Money, what should be given *Gratis*. Hence that just Scorn which the Commons shew for the Nobility, anciently so much respected by them; hence that sordid Avarice, and scandalous Parsimony seen in the Palaces of those of a new Stamp, which reflect on the illustrious Body, whereof they have been made unworthy Members; hence that insupportable Pride, which renders their Gates inaccessible to Generosity, Liberality, Humanity, and Compassion.

That scandalous Practice of selling Nobility to rich Scoundrels, prevailed much in *France* towards the latter End of the late King *Louis XIV.* twenty thousand Livres, to purchase the Employment of King's Secretary, made a Man noble and all his Posterity, though to do Justice to the Memory of that great Prince, that Mistake in him may be well attributed to the Exigency of his Affairs, his Finances having been much exhausted, by the frequent and long Wars he had been obliged to maintain against all *Europe* leagued against him.

There are five Degrees of Nobility (without reckoning a King or other sovereign Prince, who is the first Nobleman of his Kingdom or State) *viz.* that of a Duke, Marquis, Earl, or Count, Viscount, and Baron.

Duke, Dux, is a Title of Honour or Nobility, the next below Princes.

The *Dukedom*, or Dignity of Duke, is a Roman Dignity, denominated a *Ducendo*, Leading, or Commanding. Accordingly the first Dukes, *Duces*, were the *Ductores exercituum*, Commanders of Armies. Under the late Emperors the Governors of Armies were entitled *Duces*.—In after Times the same Denomination was also given to the Governors of Provinces in Time of Peace.

The first Governor under the Name of Duke, was a Duke of the *Marchia Rhetica*, of the *Grisons*, whereof mention is made in *Cassiodorus*. The *Goths* and *Vandals* upon their over-running the Western Empire, abolished the Roman Dignities wherever they settled. But the *Franks*, to please the *Gaulish* People, who had long been used to that Form of Government, made it a Point of Politics not to change any Thing therein; and accordingly divided all *Gaul* into Dutchies and Counties; and gave the Name sometimes of Dukes and sometimes of Counts, *Comites*, to the Governors thereof.

In *England*, during the *Saxons* Time, *Camden* observes, the Officers and Commanders of Armies, were called *Dukes*, *Duces*, after the ancient Roman Manner, without any Addition. After the Conqueror came in, the Title lay dormant, till the Time of *Edward III.* who created his Son *Edward*, first called the *Black Prince*, Duke of *Guineea*. After whom there were more made, in such Manner, as that their Titles descended to their Posterity. They were created with much Solemnity; *per cincturam galii, cappeque, & circuli aurei in capite impositionem*.

Though the *French* retained the Names and Form of the Ducal Government, yet under our second Race of Kings, there were scarce any such Thing as *Dukes*; but all the great Lords were called *Counts*, *Peers*, and *Barons*; excepting however the Dukes of *Burgundy* and *Aquitain*; and a Duke of *France*, which was a Dignity *Hugh Capet* himself held, corresponding to the modern Dignity of *Maire du Palais*, or the King's Lieutenant.

By the Weakness of the Kings, the Dukes or Governors made themselves Sovereigns of the Provinces trusted to their Administration. This Change happened chiefly about the Time of *Hugh Capet*; when the great Lords began to dismember the *French* Monarchy; so that that Prince found more Competitors among them than Subjects. It was even with a deal of Difficulty they could be brought to own him their Superior, to hold of him by Faith and Homage.

By Degrees, what with Force, and what by Marriages, these Provinces both *Dutchies* and *Counties*, which have been rent from the Crown, were re-united. But the Title *Duke* was no longer given to the Governors of Provinces.

From that Time, the Kings of *France*, confined the Title of Dutchy to the real Estate of the Person, reserving to themselves the Power of erecting that Estate into a *Dutchy*, by their Letters Patents, which they have done, often either to flatter the Ambition of some of their Favourites, or as a Reward for signal Services done, some of them being *Dutchies pairies*, and others only *simple Dutchies*; according as the Letters of their Erection bear it; which the better to understand, here follows a Detail of all the *French* Dutchies, either *pairies* or *simple*, according to the Date of their Erection; and by what King it was erected such.

Note, That none but Male Children can succeed in *France*, to most of the Dutchies, for if they fall, what we call *en quenouille*, i. e. to a Female Heir, then the Estate returns to the Title it had before it was made a Dutchy; and to revive that Title of Dutchy, new Letters Patent are requir'd; though there be in *France* a few *Dutchies* Female, i. e. to which Females can succeed; and which are those of *Nevers*, in its first Erection and Verification, of *Beaumont Le Vicomte*, of *Mercoeur*, of *Retbelois*, of *Joyeuse*, *Epernon*, *Elbeuf*, *Richelieu*, *Aiguillon*, and that of *Biron*, which is extinct.

Philip the Fair, erected *Britanny* into a *Dutchy* and *pairie*, in 1297; at present re-united to the Crown.

Charles IV. called the *Fair*, erected *La Marche*, which in 1316, had been a County erected by *Philip the Long*, into a Dutchy, in the Month of *December*, in 1327, together with *Moudun*, *St. Peter le Moutier*, and *Montferrand*; re-united to the Crown.

Philip of *Valois* erected *Bourbon* into a simple Dutchy, in 1329. It belongs to the House of *Condé*.

And *Orleans* into a *Dutchy pairie*, in 1344, given for Appenage to *Monsieur*, the late King's only Brother, together with those of *Valois* and *Chartres*, and the County of *Montargis*.

King *John* erected *Anjou*, an ancient County, into a *Dutchy pairie*, in the Month of *October* 1350; at present re-united to the Crown.

Bar-le-Duc into a simple Dutchy, in 1357, re-united to the Crown by a Donation, verified in Parliament in *February* 1662.

Berry, an ancient County, into a simple Dutchy, in 1360; re-united to the Crown.

Touraine, into a simple Dutchy, in 1360; re-united to the Crown.

Auvergne, into a simple Dutchy, in 1360; having been re-united to the Crown, it was given by a Contract to the House of *Boüillon*, under the Title of County, in Exchange for the Principalities of *Sedan* and *Rancourt*, and the Dutchy of *Boüillon*; that Contract verified in Parliament, *Feb.* 20, 1652.

Charles VI. erected *Valois* into a *Dutchy pairie*, in 1402; which make Part of the Appenage of the House of *Orleans*.

Nemours, into a *Dutchy pairie*, *June* 19, 1404. *Francis I.* had mortgaged it, in 1528, to the Duke of *Nemours*, of the House of *Savoy*, for the Sum of 100,000 *l.*

It belongs, at present, to the House of Orleans.

Alençon, an antient County, into a *Dutchy pairie*, Jan. 1, 1413; verified in Parliament May 13, of the same Year; re-united to the Crown.

Louis XII. erected *Longueville* into a simple Dutchy, in the Month of May 1505. This Estate was given by *Charles VII.* to the great Count of *Dunois*.

Francis I. erected *Vendôme* into a *Dutchy pairie*, in the Month of February, in 1514. *Henry the Great* gave it to his natural Son 1598.

Chatel-Eraud, an antient County, into a *Dutchy pairie*, in 1514; re-united to the Crown.

Angoulême, into a *Dutchy pairie*, in 1515.

Dunois, into a *Dutchy pairie*, in 1525; by *Madame* the Regent, Mother of King *Francis I.* but it has not been verified in Parliament.

Guise, into a *Dutchy pairie*, in the Month of January 1527; verified in Parliament the 12th of August, 1528.

Chartres, into a simple Dutchy, in the Month of June, 1528, together with *Montargis* and *Gisors*, verified in the Month of July, of the same Year.

Estoute-Ville, into a simple Dutchy, in 1534; verified at the Parliament of *Roën*, in the Month of August of the same Year.

Etampes, first a *County pairie*, into a *Dutchy pairie*, in the Month of January 1536; verified the 18th of the same Month; re-united to the Crown.

Montpensier, in the *Lower Auvergne*, into a *Dutchy pairie*, in the Month of February; verified in the Parliament of *Paris*, the 6th of March of the same Year.

Beaumont le Sonnois, in the Province of *Maine*, or *Beaumont le Vicomte*, into a simple Dutchy, in the Month of September 1543; verified the 16th of October following; it is re-united to the Crown.

Henry II. erected *Aumale* into a *Dutchy pairie*, in the Month of July 1547; verified in the Parliament of *Paris*, the 5th of January 1548; re-united to the Crown.

Albret, in 1556, once re-united to the Crown, and afterwards given by Contract to the House of *Boüillon*.

Charles IX. erected *Beaupreau* into a simple Dutchy, in 1562. It belongs to the House of *Brissac*.

Chateau-Thierry, with the Union of *Chatillon on the War*, and of *Epernay*, into a *Dutchy pairie*, the 8th of February 1566; verified in Parliament the 29th of March following. It is given to the House of *Boüillon*.

Pentbievre, in the Province of *Britanny*, into a *Dutchy pairie*, the 8th of February 1569; verified in Parliament the 15th of the same Month. It belongs at present to the Duke of *Pentbievre*, only Son of the late Count of *Tboloufe*.

Evreux, into a simple Dutchy, in the Month of October 1569; having been re-united to the Crown, it was given to the House of *Boüillon*.

Ufès, into a *Dutchy pairie*, in the Month of January 1572; verified in the Parliament of *Paris*, March 3d of the same Year. It belongs to the House of *Crussol*, who for that Reason, have took the Name of *Ufès*.

Mayenne, into a *Dutchy pairie*, in the Month of September 1573; re-united to the Crown.

Mercaur, in *Auvergne*, into a *Dutchy pairie*, in the Month of December 1569; it is re-united to the Crown.

St. Fargeau, into a *Dutchy pairie*, in the Month of September 1569; re-united to the Crown.

Henry III. erected *Loudun* into a simple Dutchy, in the Month of November 1579. It belongs to the House of *La Tremouille*.

Joyeuse, into a *Dutchy pairie*, in the Month of August 1581.

Espernon, into a *Dutchy pairie*, in the Month of November 1581.

Elbeuf, into a *Dutchy pairie*, in the Month of November 1581; verified in Parliament the 29th of March 1582.

Brienne, into a simple Dutchy in the Month of August 1587; but the Letters have not been verified.

Montbazon, into a *Dutchy pairie*, in the Month of May 1588; verified the 27th of April 1589. — This Dutchy belongs to the Duke of *Montbazon*, Prince of *Guimené*, in *Britanny*, at present reputed Chief of the eldest Branch of the House of *Roban*; though I was once intimately acquainted with a Gentleman of that House, called *Poulduc Roban*, who has much more

Right to it, but is not rich enough to dispute it with the Duke of *Montbazon*.

Ventadour, into a *Dutchy pairie*, in the Month of June 1589; verified in Parliament the 24th of January 1594; that Dutchy belongs to the House of *Levis*. The late Dutchess of *Ventadour*, was Governess of the Children of *France*.

Henry IV. erected *Croüy* into a Dutchy, in the Month of July 1598. It is at present extinct; and the Estate belongs to the Descendants of *Charles de Croüy*, Duke of *Arscot*.

Touars, antient Viscounty, into a *Dutchy pairie*, in the Month of August 1595; verified the 7th of December 1599. It belongs to the House of *La Tremouille*.

Sully, on the *Loire*, into a *Dutchy pairie*, in the Month of February 1606; verified in Parliament the 9th of March of the same Year. It belongs to the House of *Bethune*.

Louis XIII. erected *Damville* into a *Dutchy pairie*, in the Month of September 1610, at present extinct. The Estate belongs to the House of *Levis*.

Chateau Roux, into a *Dutchy pairie*, in the Month of May 1616. The present King *Louis XV.* has given that Dutchy to *Mademoiselle de la Tournelle*, of the House of *Mailli*.

Maille Luynes, into a *Dutchy pairie*, in the Month of August 1619. — This Dutchy belongs to the House of *Albert*.

Lédiguières, into a *Dutchy pairie*, in the Month of May 1611. This Dutchy is extinct, together with the House of *Bone*, of *Crequi*, of *Blanchefort*; and the greatest Part of the large Estate of that House, which amounted to above 100,000 *l.* Sterling, *per Annum*; is fell into the House of *Villeroy*.

Seurre-Bellegarde, in the Month of September 1619. This Estate belongs to the House of *Condé*.

Brissac, into a *Dutchy pairie*, in the Month of April 1611. It belongs to the House of *Coffé*.

Alwin, into a *Dutchy pairie*, the 26th of February 1620.

Châlines, into a *Dutchy pairie*, in the Month of January 1621.

Villars, into a *Dutchy pairie*, in the Month of July 1652. That Dutchy is in the House of *Branças*, settled in *France*.

Richelieu, into a *Dutchy pairie*, in the Month of August 1631.

Rochefoucault, into a *Dutchy pairie*, the 4th of September 1631.

La Valette, into a *Dutchy pairie*, in the Month of March 1622.

Pondevaux, into a simple Dutchy, by *Louis XIII.* in the Month of February 1623.

Montmorency, into a *Dutchy pairie*, by *Henry II.* in the Month of July 1551. It belongs to the House of *Condé*.

Rais, into a *Dutchy pairie*, in the Month of November 1581; extinct.

Fronsac, into a *Dutchy pairie*, in January 1634. It belongs to the Duke of *Richelieu*.

St. Simon, into a *Dutchy pairie*, in the Month of January 1635.

La Force, into a *Dutchy pairie*, the 29th of July 1637.

Aiguillon, into a *Dutchy pairie*, in the Month of August 1599.

Valentinois, once re-united to the Crown, but given afterwards, viz. in 1642; by *Louis XIII.* to the Prince of *Monaco*.

Roban, into a *Dutchy pairie*, by *Henry the Great*, in the Month of April 1603. That Dutchy is in the House of *Chabot*, by Marriage, with the Heiress of the House of *Roban*.

Nevers, into a *Dutchy pairie*, by *Francis I.* in January 1538.

Pincy-Luxembourg, into a *Dutchy pairie*, in the Month of September 1576.

Carignan, into a *Dutchy pairie*, in Favour of the House of *Savoy*, sealed in *France*, by *Louis XIV.* in the Month of July 1662.

Verneville, into a *Dutchy pairie*, the 15th of December 1663.

Etrées, into a *Dutchy pairie*, the 15th of Dec. 1663.

Gramont, into a *Dutchy pairie*, the 31st of Dec. 1643.

La Meilleraye, into a *Dutchy pairie*, in 16—
Retbelois, into a *Dutchy pairie*, in December 1582,
 by Henry III.
Villeroy, into a *Dutchy pairie*, in 1651, by the late
 King Louis XIV.
Mortemar, into a *Dutchy pairie*, in 1653.
Crequi, into a *Dutchy pairie*, in 1653.
St. Aignan, into a *Dutchy pairie*, in 1663.
Foix-Rendan, into a *Dutchy pairie*, the 15th of De-
 cember, 1663.
Liancourt, into a *Dutchy pairie*, in 1643.
Géres, into a *Dutchy pairie*, in 1648.
Noailles, into a *Dutchy pairie*, the 15th of December,
 1663.
Coisling, into a *Dutchy pairie*, the 15th of December,
 1663.
Choiseul, into a *Dutchy pairie*, the 2d of December,
 1663.
Aumont, *Dutchy pairie*, verified in Parliament the 2d
 of December, 1665.
La Ferte-Senneterre, *Dutchy pairie*, verified in Par-
 liament the 2d of December, 1665.
Montausier, into a *Dutchy pairie*, in the Month of
 August, 1664.
La Valiere, into a *Dutchy pairie*, the 13th of May,
 1667.
Rouanez, into a *simple Dutchy*, in November, 1566.
Chevreuse, into a *Dutchy pairie*, in the Month of
 March, 1612.
Beaufort, a *simple Dutchy*, Female, erected a-new in
 May, 1668. in favour of *Charles Francis Frederick*, of
Montmorency Luxembourg, Prince of *Tingry*.

The Quality of the twelve antient Peers of *France*, is
 no more at present but a mere Dignity, in virtue
 thereof, those who possess it in *France* have Rank at
 the Coronation of the Kings, their Seats in Parliament,
 and in the Assembly of the *Estats Generaux*, and enjoy
 the Honours of the *Louvre*. Their Institution is so very
 uncertain, that it is impossible to draw the Origin there-
 of from History; some attributing it to *Hugh Capet*,
 and others to *Charlemagne*.

The Origin of the Name, and of the Functions of
 Peers of *France*, must be drawn, according to *Pitbou*,
 from the common Use of the Fiefs, which is, that the
 Vassals holding Fiefs, moving plainly and directly from
 the same Lord, are called *Peres curie aut domus*; which
 is nothing else but to be *Peers of Fiefs*, or of *Court*,
 who must be present when a Lord takes Possession of
 his Estate; and when the Causes of the Fiefs are tried,
 and have several other Rights in common, in Propor-
 tion with the Peers of *France*, who likewise assist at the
 Coronation of the King, are Counsellors in his Court of
 Parliament, which for that Reason is called the *Court of*
the Peers. So that, in a Word, they are nothing else but
 Fief-holders of the Kingdom, and depending immediately
 on the Crown. Such were the seven Peers, in the Time
 of *Louis the Younger*, in 1179, or in the Time of *Hugh*
Capet, who re-united to the Crown the *Dutchy pairie* of
France, or of *Paris*, which he possessed.

So that there were but six antient Peers left, viz. the
 Duke of *Burgundy*, that of *Normandy*, and that of *Aqui-*
taine, the Count of *Toulouse*, that of *Flanders*, and that
 of *Champagne*.—Afterwards were added to them at
 different Times, the ecclesiastick Peers, to the Number
 of six, among whom *Louis the Younger*, in 1179, gave
 the Precedency to that of *Rheims*, and the Prerogative
 of anointing and crowning the King, That Number of
 twelve Peers has continued ever since.

Du Cange, in his Observations on the Establishments,
 at the End of the Life of *St. Louis*, by the Sire of *Join-*
ville, pag. 178. says, that our Kings, who had a great
 Number of Vassals and Barons, reduced their Peers to
 twelve.

Among the six Ecclesiasticks, there are three Dukes
 and three Counts; and among the secular, three Dukes
 and three Counts likewise.

The three ecclesiastick Dukes and Peers of *France*,
 are the Archbishop of *Rheims*, the Bishop of *Laon*, and
 the Bishop of *Langres*, and the three ecclesiastick Counts
 and Peers of *France*, are the Bishop of *Beauvais*, the
 Bishop of *Châlons*, and the Bishop of *Noion*.

The six secular, were the Duke of *Burgundy*, that of

Normandy, and that of *Guienne*; the Count of *Toulouse*,
 that of *Flanders*, and that of *Champagne*.

Their several Functions at the anointing and Corona-
 tion of the King are, that

The Archbishop of *Rheims*, anoints the King.

The Bishop of *Laon*, carries the *St. Ampoule*.

The Bishop of *Langres*, the Sceptre.

The Bishop of *Beauvais*, the royal Mantle.

The Bishop of *Châlons*, the Ring.

The Bishop of *Noion*, the Belt.

The Duke of *Burgundy*, carries the royal Crown, and
 girts the Sword to the King.

The Duke of *Guienne*, carries the first square Banner.

The Duke of *Normandy*, the second.

The Count of *Toulouse*, the Spurs.

The Count of *Champagne*, the royal Banner.

The Day of the King's Coronation, and during the
 Ceremony, those Peers have on their Head a Coronet.
 But because those six Laick Peers, have been re-united
 to the Crown, except one Part of *Flanders*, which is
 yet in foreign Hands; six Princes or Lords are chosen
 to discharge their Functions, and represent the Peers.

The Dukes in *France*, take no Titles different from
 those of other Lords, all indifferently stiling themselves
 high and mighty Lords, &c. *Messire*, &c.

In *England*, Duke is become a mere Title of Dignity,
 affected to a Person, and his Heirs male, without giv-
 ing him any Domaine, Territory, or Jurisdiction, over
 the Place whereof he is Duke. All the Advantages
 thereof consist in the Name, and the Precedence it
 gives.

The Dukes of our Days retain nothing of their an-
 tient Splendor, but the Coronet of their Escutcheon;
 which is the only Mark of their departed Sovereignty.
 They are created by Patent, Cincture of the Sword, Mantle
 of State, Imposition of a Cap, and Coronet of Gold on
 the Head, and a Verge of Gold in their Hand.

The eldest Sons of Dukes are by the Courtesy of
England and *France*, stiled *Marquises*. In *France* the
 second Sons Counts, the third Viscounts, the fourth
 Barons, and the fifth, Chevalier. In *England* all the
 younger Sons of Dukes are only called Lords, with the
 Addition of the christian Name, as Lord *James*, Lord
Thomas, &c. and take Place of Viscounts, though not
 so privileged by the Laws of the Land.

A Duke has the Title of *Grace* in *England*, and be-
 ing wrote to, is stiled in the Heralds Language, *most high*,
potent, and *noble Prince*.

Dukes of the Blood Royal, are stiled *most high*, *most*
mighty, and *illustrious Princes*.

The first Duke in *England*, after those of the Blood
 Royal, is the Duke of *Norfolk*; but being a Roman Ca-
 tholick he does not enjoy the Privileges annexed to his
 high Dignity.

Note, That there are also sovereign Princes, who bear
 the Title of *Duke*, such are the Duke of *Lorain*,
 Duke of *Modena*, Duke of *Parma*, Duke of *Holstein*,
 &c. antiently the Dukes of *Milan*, of *Burgundy*, of
Britanny, &c. And two who stile themselves *Grand*
Dukes; as the *Grand Duke* of *Tuscany*, and the *Grand*
Duke of *Muscovy*, now called *Czar*, or Emperor of
Russia. In *Germany*, there is also the *Arch Duke* of
Austria, which is a very antient Title. There have
 also formerly been *Arch-Dukes* of *Lorrain* and *Brabant*.
Austria was erected into a Marquisate by *Otho*, or
Henry I. and into a *Dutchy* by *Frederick I.* in 1156;
 but we don't well know when, nor why the Title *Arch-*
duchy was given it:—It is commonly held, that Duke
Frederick IV. first assumed the Quality; others say
 it was first given by the Emperor *Maximilian I.* in
 1459, and ample Privileges annexed to it. The
 principal Privileges of this State are, that the *Arch-*
duke shall distribute Justice in his own Dominions
 without Appeal; that he shall be judged to have re-
 ceived the Investiture of his States, after having de-
 manded it three Times; and cannot be deprived of
 his Countries, even by the Emperor, and the States
 of the Empire: That no Affair of the Empire can be
 concluded without his Participation; and that he has
 a Power of creating Counts, Barons, and Gentlemen,
 throughout the whole Empire; which are Privileges

to which the other Dukes of the Empire are Strangers.

Note, also, That *Duke Duke* is a Quality given in *Spain* to a Grandee of the House of *Sylva*, on account of its having several Dutchies, by the uniting of two considerable Houses in his Person. *Don Roderigo de Sylva*, eldest Son of *Don Ruy Gomer de Sylva*, and Heir of his Dutchies and Principalities, married the eldest Daughter of the Duke de *Linfantado*; in virtue of which Marriage, the present Duke de *Pastrana*, who is descended therefrom, and is Grandson of *Don Roderigo de Sylva*, has added to his other great Titles that of *Duke-Duke*, to distinguish himself from other Dukes, some whereof may enjoy several Duchies, but none so considerable ones, nor the Titles of such eminent Families.

A *Marquis*, or *Marquess*, *Marchio*, is a Title given to a Person in Possession of a considerable Demesne, erected into a Marquisate by Letters Patent, holding a middle Place between the Dignity of a Duke, and that of an Earl or Count.

Note, That the Word *Marquis*, according to some Authors, comes from the *Marcomanni*, an antient People who inhabited the Marshes of *Brandebourg*; others derive it from the German, *Marcke*, Limit; and others from *Marcissa*, which in the *Celtick* Language signified a Wing of Cavalry: *Nicod* derives it from the corrupt Greek *νομαρχια*, Province: *Alciat* and *Fauchet* bring it from *Mark*, Horse, taking a *Marquis* to be properly an Officer of Horse: *Menage* derives it from *Marca*, Frontier; and *Selden*, *Krantrius* and *Hottoman* do the same: Lastly, *Pasquier* fetches *Marquis* from the old French *Marche*, Limit, or from *Marchir*, to confine; the Guard of the Frontiers being committed to them.

Marquesses, were antiently Governors of Frontier Cities or Provinces, called *Marshes*.

In *Germany* *Marquesses* are called *Margraves*.

Marquis, is ordinarily a *French* Title; the *Romans* were unacquainted with it: In the *Notitia Imperii*, they are called *Comites Limitanii*.—The first Time we heard of *Marquesses*, *Marchiones*, is under *Charlemagne*, who created Governors in *Gascony* under this Denomination.

Alciat has started a Question, whether a *Marquis* or Count should have the Precedence? To decide the Question he goes back to the antient Function of Counts, and observes that Counts who are Governors of Provinces, are above *Marquesses*, who are only Governors of Frontiers; and that *Marquesses* who are Governors of frontier Cities, are above Counts who are Governors of small Towns. He adds, that in consequence of this Distinction, the Book of Fiefs sometimes places *Marquesses* above Counts, and sometimes Counts above *Marquesses*.

In *France* we have two Sorts of *Marquesses*, viz. true *Marquesses*, i. e. those *Marquesses* whose Estates have been erected into Marquisates, or the Sons of Dukes; and petty *Marquis*, i. e. those who have the Vanity to call themselves *Marquesses*, without any Right or Title.

Troissart observes, that the Marquisate of *Juliers* was erected into a County; but now a-days neither *Marquesses* nor Counts are any longer Governors; and as they are mere Titles of Honour, the Counts make no Scruple of resigning the Precedency.

King *Richard II.* was the first who introduced the Dignity of *Marquis* in *England*, by creating *Robert de Ferr*, Earl of *Oxford*, *Marquis* of *Dublin*; but this was a Title without Office, the Frontiers being governed by Lords Marchers.

A *Count*, *Comes*, is a Nobleman, who possesses a Domain erected into a County.

English Counts are distinguished by the Title of *Earls*, but few still retain the proper Name.

The Dignity of a Count, is a Medium between that of a Duke and a Baron.

According to the modern Use, most Plenipotentiaries and Ambassadors assume the Title of *Counts*, though they have no Counties, as the Count d'*Arvaux*, Plenipotentiary at the Congress of *Nimeguen*, &c.

Antiently, all Generals, Counsellors, Judges, and

Secretaries of Cities under *Charlemagne*, were called Counts; the distinguishing Character of a Duke and a Count being this, that the latter had but one Town under him, but the former several.

A Count has a Right to bear on his Arms a Coronet, adorned in *England* with three precious Stones, and surmounted with three large Pearls, whereof those in the Middle and Extremities of the Coronet advance above the rest. In *France* a Count's Coronet is all surmounted with Pearls even with one another.

Counts were originally Lords of the Court, or of the Emperor's Retinue, and had their Name *Comites*, à *Comitando*; hence those who are always in the Palace, or at the Emperor's Side, were called *Counts Palatine*, or *Comites à latere*.

In the Time of the Commonwealth, *Comites*, among the *Romans*, was a general Name for all those who accompanied the Proconsuls and Proprætors into the Provinces, there to serve the Commonwealth, as the Tribunes, Præfecti, Scribes, &c.

Under the Emperors *Comites* were the Officers of the Palace. The Origin of what we now call *Couns* seems owing to *Augustus*, who took several Senators to be his *Comites*, as *Dion* observes, i. e. to accompany him in his Voyages and Travels, and to assist him in hearing of Causes; which were here judged with the same Authority as in full Senate. *Gallienus* seems to have abolished this Council, by forbidding the Senators being found in the Armies; and none of his Successors re-established it.

These Counsellors of the Emperor, were really Counts *Comites*, i. e. Companions of the Prince; and they sometimes took the Title thereof, but always with the Addition of the Emperor's Name whom they accompanied; so that it was rather a Mark of their Office, than a Title of Dignity.

Constantine was the first who converted it into a Dignity, and under him it was that the Name was first given absolutely.

The Name once established was in a little Time indifferently conferred, not only on those who followed the Court, and accompanied the Emperor, but also on most Kinds of Officers; a long List whereof is given us by *Du Cange*.

Eusebius tells us, that *Constantine* divided the Counts into three Classes; the first bore the Title of *Illustres*, the second that of *Clarissimi*, and afterwards *Spellabiles*, the third were called *Perfectissimi*.

Of the two first Classes was the Senate composed; those of the third had no Place in the Senate, but enjoyed several others of the Privileges of Senators.

There were Counts who served on Land, others at Sea, some in a civil, some in a religious, and some in a legal Capacity, as *Comes Aerarii*, *Comes Capelle*, *Comes Archiatrorum*, *Comes Commenciorum*, *Comes Vestiaris*, *Comes Horreorum*, *Comes Opsoniorum*, or *Annone*, *Comes Domesticorum*, *Comes Equorum Regiorum*, or *Comes Stabuli*, *Comes Domorum*, *Comes Excubitorum*, *Comes Notariorum*, *Comes Legum*, or *Professor in Jure*, *Comes Limitum Marcarum*, *Comes Oræ Maritimæ*, *Comes Portus Romæ*, *Comes Patrimonii*, &c.

The *Franks*, *Germans*, &c. passing into *Gaul* and *Germany*, did not abolish the Form of the *Roman* Government; and as the Governors of Cities and Provinces were called Counts, *Comites*, and Dukes, *Duces*, they continued to be called so.

These Governors commanded in Time of War; and in Time of Peace administered Justice. Thus, in the Time of *Charlemagne*, Counts were the ordinary Judges and Governors of the Cities, all under one.

These Counts of Cities were beneath the Dukes and Counts who presided over Provinces; the first being constituted in the particular Cities under the Jurisdiction of the latter. The Counts of Provinces were in nothing inferior to Dukes, who themselves were only Governors of Provinces.

Under the last of the second Race of the Kings of *France*, they got their Dignity rendered hereditary, and even usurped the Sovereignty when *Hugh Capet* came to the Crown: His Authority was not sufficient to oppose their Encroachments; and hence it is they date the Privilege of wearing Coronets in their Arms: They assumed

it, then, as enjoying the Rights of Sovereigns in their particular Districts or Counties. But by Degrees, most of the Counties became re-united to the Crown.

The Quality of *Count* is now become very different from what it was antiently; being now no more than a Title, which a King grants by erecting a Territory into a County, with a Reserve of Jurisdiction and Sovereignty to himself.

At first there was no Clause in the Patent of Erection intimating the Reversion of the County to the Crown in Default of Heirs Male. But *Charles IX.* to prevent their being too numerous, ordained that Dutchies and Counties, in Default of Heirs Male, should return to the Crown.

The Point of Precedence, between *Counts* and *Marquisses*, has been formerly much controverted; the Reason was, that there are *Counts* who are Peers of *France*, but no *Marquisses*; but the Point is now given up, and *Marquisses* take Place; though antiently when *Counts* were Governors of Provinces, they were on a Level even with *Dukes*.

William the Conqueror, as is observed by *Camden*, gave the Dignity of *Counts* in Fee to his Nobles; annexing it to this or that County or Province, and allotting for their Maintenance a certain Proportion of Money, arising from the Prince's Profits in the Pleadings and Forfeitures of the Provinces. To this Purpose he quotes an antient Record, thus; *Hen. II. Rex Angliæ his verbis Comitum creavit; Sciatis nos fecisse Hugonem Bigot Comitem de Norf. &c. de tertio denario de Norwich & Norfolk, sicut aliquis Comes Angliæ, &c.*

Counts or *Earls* are now created by Charter, without any Authority over, or particular Relation to, their Counties; and without any Profit arising thence, except some annual Stipend out of the Exchequer, for Honour Sake. The Number of *Earls* being of late much increased, and no more Counties being left for them, several of them have made Choice of some eminent Part of a County, as *Lindsey, Holland, Craven, &c.* others of some Towns, as *Marlborough, Exeter, Bristol, &c.* and others of some Village, or their own Seat, Park, &c. as *Gedolpin, Bolton, Danby, Wharton, &c.*

There are two *Earls* in *England*, which are not local, *i. e.* not dignified from any Places, but from noble Families, *viz.* *Earl Rivers*, and *Earl Paulet*. A third is denominated from his Office, *viz.* the *Earl Marshal*, who is a great Officer, having antiently several Courts under his Jurisdiction, as the Court of Chivalry, now almost forgotten; and the Court of Honour lately revived.

He has also some Pre-eminence in the Court of *Marshallsea*; where he may sit in Judgment against Criminals, offending within the Verge of the Court; whence the chief Officer under him is called *Knight-Marshal*. — Under him is also the Herald's Office, or College of Arms; as observed in my Treatise of Heraldry.

The Office of *Earl-Marshal* is hereditary in the most noble Family of *Howard*; and enjoyed by the Duke of *Norfolk*, the principal Branch thereof; though now, because *Roman Catholics*, it is discharged by Deputation; But yet it is to be observed, it is not given out of the Name and Family of *Howard*.

Earls are created by Cincture of Sword, Mantle, Cap, and a Coronet put on his Head, and a Charter in his Hand. They are styled by the King, *Consanguinei nostri*, our Cousins. Their Title is, *Most potent and noble Lord*. Their Coronet has the Pearls raised on Points, with Leaves between.

Earl was a mighty Title among the *Saxons*: It is observed to be the most antient of any of the Peerage; and that there is no other Title of Honour in Use among the present Nobility, which was likewise used among the *Saxons* beside it. — The original Titles of Honour among the *Saxons*, were *Atheling, Thane*, and *Thegn*. The first was appropriated to those of the Royal Family: The other two to the rest of the Nobility: Only the *Thani* were afterwards distinguished into *Majores* and *Minores*.

Note, That the *Majores Thani*, or *Thanes*, were those who attended the *English-Saxon* Kings in their Courts, and who held Lands immediately of the King: Whence in *Doom's Day Book* they are promiscuously called *Thani* and *Servientes Regis*. Soon after the Con-

quest the Name was disused; and instead thereof they were called the *King's Barons, Barones Regis*. Their Origin is referred to *King Canutus*, who, taking the Chief of the *Danish* Nobility, to the Number of 3000, for his Guard; and arming them with Battle-Axes, and Sabres with gilt Handles, called them *Thing-lith*, from the two *Danish* Words *theing* or *thein*, Body of Nobility, and *lith*, Order of Battle. The ordinary *Thanes*, or *Thani minores*, were the Lords of Manors, who had particular Jurisdiction within their Limits, and over their own Tenants. These two changed their Name for that of *Barons*; and hence their Courts are called *Courts-Baron* to this Day. In old Authors, Charters, &c. we also meet with *Thane*, as signifying a Nobleman; sometimes a Freeman; and sometimes a Magistrate.

The *Germans* call a *Count, Graf*, or *Graff*; which, according to a modern Critick, properly signifies *Judge*; and is derived from *Gravio* or *Graffio*, of *γραφο*, I write. They have several Kinds of these *Counts* or *Graffs*, as *Landgraves, Marchgraves, Burghgraves*, and *Palgraves*, or *Counts Palatine*.

This last Title, *i. e.* *Count Palatine, Comes Palatinus*, in antient Customs was a Title given to all Persons who had any Office or Employment in the Prince's Palace.

Matthæus says, that *Palatines* were originally those who had the Super-Intendance of the Palace; the same with what the *Greeks* called *Curopolatæ*, and the *French* *Maires du Palais*; tho' in Time the Name became more general.

The only *Palatine* of this Kind now subsisting, is the Prince *Palatine* of the *Rhine*.

Palatine was afterwards a Title conferred on those delegated by Princes to hold Courts of Justice in the Provinces; and on such among the Lords as had a Palace, *i. e.* a Court of Justice in their own Houses.

The *French* Writers make the *Palatines* of *Champagne* to be the first who bore the Title; which they will have it, the *Germans* and other People borrowed from them; not they from the *Germans*.

At present, the Word *Palatine* is restrained, to a Prince of *Germany*, or a Lord of *Poland* possessed of a *Palatinate*.

In the Code we find a Title *De Palatinis sacrarum Largitionum*, who were a Kind of Treasurers of the Empire.

Note, That *Palatinate, Palatinatus*, is a Province or Signory, possessed by a *Palatine*, and from which he takes his Title and Dignity. The *Palatinates* now subsisting, are either those of *Germany* or *Poland*. Those of *Germany* are the Principalities of the *Upper* and *Lower Rhine*, *i. e.* of *Bavaria* and the *Rhine*. The *Palatinates* in *Poland*, are the Provinces and Districts of the *Polish* Grandees, or Senators, who are the Governors thereof.

Note also, That the Territory of a *Count* or *Earl*, was originally called a County. But now it is used in the same Sense with *Shire*; the one Word coming from the *French*, the other from the *Saxon*. In this View, a County is a Circuit or Portion of the Realm, into 32, of which the whole Land, *England* and *Wales*, is divided, for the better Government thereof, and more easy Administration of Justice therein. Those Counties are subdivided into *Rapes, Laths, Wapentakes, Hundreds*; and these again into *Tithings*. For the Execution of the Laws in the several Counties, excepting *Cumberland, Westmoreland*, and *Durham*, every *Michaelmas* Term, Officers are appointed, under the Denomination of Sheriffs. This Officer has a double Function; first, *ministerial*, to execute all Processes and Precepts of the Court of Law directed to him: And secondly, *judicial*; whereby he has Authority to hold two Courts, the one called the Sheriff's Turn, the other the County-Court. Other Officers of the several Counties are, a *Lord-Lieutenant*, who has the Command of the Militia of the County; *Custos Rotulorum, Justices of Peace, Bailiffs, High Constable*, and *Coroner*. Of the 52 Counties, there are four of special Note, which are therefore termed *Counties Palatine*, as *Lancaster, Chester, Durham*, and *Ely*; *Pembroke* also, and *Hexham*,

Hexham, were antiently *Counties Palatine*; which last belonged to the Archbishop of *York*, and was stripped of its Privilege in the Reign of Queen *Elizabeth*, and reduced to be a Part of the County of *Northumberland*. The chief Governors of these *Counties Palatine* heretofore, by a special Charter from the King, sent out all Writs in their own Names; and touching Justice, did all Things as absolutely as the King himself in other Counties; only acknowledging him their Superior and Governor. But in *Henry VIIIth's* Time, the said Power was much abridged. There is also *County-Corporate*, which is a Title given to several Cities, or antient Boroughs, on which the *English* Monarchs have thought fit to bestow extraordinary Privileges; annexing to them a particular Territory, Land, or Jurisdiction. — The chief of these, is the famous City of *London*; with *York*, *Canterbury*, *Bristol*, *Chester*, *Norwich*; the Town of *Kingston upon Hull*, *Newcastle upon Tyne*, *Haverford West* in *Wales*, &c.

A *Vicount*, or *Viscount*, is a Degree of Nobility, next below a Count or Earl, and above a Baron.

Camden observes, that this is an antient Name of Office, but a new one of Dignity, never heard of in *England* till *Henry VIth's* Days, who, in his 18th Year, created in Parliament *John Lord Beaumont*, Viscount *Beaumont*; but it is much more antient in other Countries. The second Viscount in *England*, is that excellent Nobleman my Lord *Montacute Browne*.

Du Cange, indeed, will have the Dignity to have had its first Rise in *England*; but it is much more probable, it was first brought over hither by the *Normans*.

The Privileges of a *Viscount* are, that he may have a Cover of Assay held under his Cup when he drinks, and may have a Traverse in his own House. And a Viscountess may have her Gown bore up by a Man, out of the Presence of her Superiors; and in their Presence by a Woman.

A *Baron*, is a Lord or Peer of the lowest Class; or a Degree of Nobility, next below that of a Viscount, and above that of a Knight or Baronet.

Note, That *Baron* is a Term whose Origin and primary Import is much contested; some will have it originally denote a Man, *avnp*; some a Hero or valiant Man; some a *Libertinus* or Freeman; some a great or rich Man; some a Vassal or Liege-Man. *Menage* derives it from the *Latin Baro*, which we find used in the pure Age of that Language for *Vir*, a stout or valiant Man: Whence, according to this Author, it was, that those placed next the King in Battles, were called *Barones*, as being the bravest Men in the Army: And as Princes frequently rewarded the Bravery and Fidelity of those about them with Fees, the Word came to be used for any noble Person, who holds a Fee immediately of the King. *Isidore*, and after him *Camden*, takes the Word in its original Sense to signify a mercenary Soldier. *Messieurs* of the *Port Royal* derive it from *βαρας*, Weight, or Authority; *Cicero* uses the Word *Baro* for a stupid brutal Man; and the old *Germans* make mention of buffetting a Baron, *i. e.* a Villain; as the *Italians* still use the Word *Barone*, to signify a Beggar. *M. de Marca*, derives *Baron* from the *German Bar*, Man, or Freeman: Others derive it from the old *Gaulish*, *Celtick*, and *Hebrew* Languages: But the most probable Opinion is, that it comes from the *Spanish Varo*, a stout, noble Person; whence Wives come to call their Husbands Princes, and their Tenants *Barons*. In the *Salick* Laws, as well as the Laws of the *Lombards*, the Word *Baron* signifies a Man in the general; and the old Glossary of *Philomenes*, translates *Baron* by *avnp*, Man.

Barons, in *England*, are Lords of Parliament and Peers of the Realm, and enjoy all the Privileges thereof. They are not girt with a Sword at their Creation, nor had they any Coronets till the Reign of King *Charles II.* who gave them a Circle of Gold with six Pearls set close to the Rim.

In antient Records, the Word *Barons* included all the Nobility of *England*, because regularly all Noblemen were *Barons*, though they had a higher Dignity. And therefore the Charter of King *Edward I.* which is an Exposi-

tion of what relates to *Barons* in *Magna Charta*, concludes, *testibus Archiepiscopis, Episcopis, Baronibus, &c.* and the great Council of the Nobility, when they consisted of, besides Earls and Barons, Dukes, Marquisses, &c. were comprehended under the Name *de la Councel de Baronage*.

Barons by antient Tenure, were those who held certain Territories of the King, who still reserved the Tenure in Chief to himself. We also read of *Barons by temporal Tenure*, who are such as hold Honours, Castles, Manours, as Heads of their *Barony*, that is, by Grand Sergeanty; by which Tenure they were antiently summoned to Parliament. But at present a *Baron by Tenure* is no Lord of Parliament, till he be called thither by Writ.

The *Barons by Tenure* after the Conquest, were divided into *Majores* and *Minores*, and summoned accordingly to Parliament; the *Majores* or greater *Barons*, by immediate Writ from the King; the *Minores* or lesser *Barons*, by general Writ from the High Sheriff, at the King's Command.

The Antients distinguished the greater *Barons* from the less, by attributing high, and even sovereign Jurisdiction to the former, and only inferior Jurisdiction over smaller Matters to the latter.

The Lordship or Fee of a *Baron*, either temporal or spiritual, is called *Barony*. In which Sense *Barony* amounts to the same with what is otherwise called Honour.

A *Barony* may be consider'd as a Lordship held by some Service, in Chief of the King, coinciding with what is otherwise called *grand Sergeanty*.

Note, That *Baronies*, in their first Creation, moved from the King himself, the chief Lord of the whole Realm; and could be holden immediately of no other Lord: For Example, the King enfeoffed a Man, of a great Seignury in Land; to hold to the Person enfeoffed and his Heirs, of the King and his Heirs, by Baronial Service, to wit, by the Service of 20, 40, 60 Knights, or of such other Number of Knights, either more or less, as the King by his Enfeoffment limited or appointed. In the Ages next after the Conquest, when a great Lord was enfeoffed by the King of a large Seignury, such Seignury was called a *Barony*; but more commonly an Honour, as the Honour of *Gloucester*, the Honour of *Wallingford*, the Honour of *Lancaster*, the Honour of *Richmond*, and the like. There were in *England* certain Honours, which were often called by *Norman* or other foreign Names, that is to say, sometimes by the *English*, and sometimes by the foreign Name. This happened when the same Person was Lord of an Honour in *Normandy*, or some other foreign Country, as also of an Honour in *England*. For Example, *William de Forz*, *de Force*, or *de fortibus*, was Lord of the Honour of *Albemarle* in *Normandy*, he was also Lord of two Honours in *England*, to wit, the Honour of *Holderness*, and the Honour of *Skips* in *Craven*. These Honours in *England*, were sometimes called by the *Norman* Name, the Honour of *Albemarle*, or the Honour of the Earl of *Albemarle*. In like Manner the Earl of *Britanny*, was Lord of the Honour of *Britanny*, in *France*, and also of the Honour of *Richmond* in *England*. The Honour of *Richmond*, was sometimes called by the foreign Name, the Honour of *Britanny*, or the Honour of the Earl of *Britanny*. This serveth to explain the Terms, Honour of *Albemarle* in *England*, Honour *Albemarlic*, or *Comitis Albermarlic* in *Angliâ*; Honour *Britannicæ*, or *Comitis Britannici* in *Angliâ*, the Honour of *Britanny*, or of the Earl of *Britanny* in *England*. Not that *Albemarle* or *Britanny* were in *England*, but that the same Person respectively was Lord of each of the said Honours abroad, and each of the said Honours in *England*.

The *Baronies* belonging to Bishops, are by some called *Regalia*, as being held solely on the King's Liberality. These do not consist in one *Barony* alone, but in many; for *tot erant Baronie, quot majora prædia*.

A *Barony*, according to *Boraston*, is a Right Indivisible. Therefore, if an Inheritance be to be divided among Copartners, though some capital Messuages may be

be divided, yet if the capital Messuage be the Head of a County or Barony, it may not be parcelled; and the Reason is, lest by this Division, many of the Rights of Counties and Baronies, by Degrees, come to nothing, to the Prejudice of the Realm; which is said to be composed of Counties and Baronies.

All Lords of the different Degrees heretofore mentioned, are in *England*, Peers of the Realm, i. e. have their Seats and Votes, in the Upper House of Parliament; hence called the *House of Peers*.

All Peers of the Realm being consider'd as the King's hereditary Counsellors, their Persons, out of Parliament-Time, are privileged (as others in Parliament Time) from all Arrests, unless for Treason, Felony, or Breach of Peace, Condemnation in Parliament, or Contempt to the King. No *Supplicavit* can be granted against them; no *Capias* or *Exigent* sued out against them, for Actions of Debt or *Trespafs*. No *Essoin* lies against any Peer of the Realm. In criminal Causes, Treason, or Felony, they cannot be tried by any other Jury, but by a Jury of Peers of the Realm, who are not as other Juries, to be put to their Oath, but the Verdict given in upon their Honour sufficeth. In civil Causes they are not to be impanelled upon any Jury, nor upon any Inquest, *de facto*, though in a Matter between two Peers. In case any Peer be returned upon any such Jury, there is a special Writ for his Discharge. Upon no Case to be bound upon their good Behaviour, nor put to swear they will not break the Peace, but only to promise it upon their Honour; which was ever accounted so sacred, as upon no Terms to be violated. A Peer of the Realm may not be put to the Rack or Torture to discover the Truth, tho' accused of High-Treason. Every Peer of the Realm called to Parliament has the Privilege, in his lawful Absence, to constitute a Proxy to vote for him, which none of the Commons may do. Also in Places of Trust committed to them, they are allowed to make Deputies by reason of the Necessity supposed in the Law, of their Attendance on the Person of the King, though neither civil Law nor common Law allow any other Testimony to be valid, but what is given upon Oath; yet the Testimony of a Peer of *England* given in upon his Honour, without any Oath, is esteemed valid; and they were antiently examined upon their Allegiance, and the Loyalty of their Chivalry, and to put in their Answer to a Bill *super honorem*, without taking an Oath; though of later Times, that Privilege, by the neglect of some Lords, has been infringed sometimes. A Day of Grace by the Favour of the Court, is not to be granted to the Plaintiff in any Suit or Action, wherein a Peer of the Realm is Defendant; and this by Statute-Law, because the Law presumes, that a Peer of the Realm must always be ready to attend the Person of the King, and the Service of the Commonwealth; and therefore it is not to be delayed any longer than the ordinary Use of the Court, but to have Expedition of Justice.

At the Beginning of Parliament, when the Oath of Supremacy is exacted of all those of the House of Commons, yet it is not required of any of the Lords, because the King is presumed to be otherwise assured of their Loyalty and Fidelity.

In all Cases, wherein the Benefit of the Clergy is allowed to other Men; and also in divers Cases, where that Privilege is taken away from other Men, every Peer of the Realm, having Place and Voice in Parliament, shall, upon his Request, by Stat. 1 *Edw. VI.* without burning in the Hand, Loss of Inheritance, or Corruption of Blood, be adjudged for the first Time, as a Clerk Convict, though he cannot read.

For the suppressing of Riots and Routs, the Sheriff may raise the *Posse Comitatus*, that is, all able Men are to assist him; yet may not the Sheriff command the Person of any Peer of the Realm to attend that Service.

A Baron of Parliament being sent for by the King's Writ or Letter, or by his Messenger, to come to Court, or to Parliament, or to appear before the Council Board, or in his Court of Chancery, may, both coming and returning, by the King's Forest or Park, kill one or two Peers.

In any civil Trial, where a Peer of the Realm is Plaintiff or Defendant, there must be returned of the Jury, at least one Knight, otherwise the *Array* may be

quasht by Challenge.

The Laws of *England* are so tender of the Honour, Credit, Reputation, and Persons of Noblemen, that there is a Statute on purpose to hinder all Offence by false Reports, whereby any Scandal to their Person may arise, or Debate and Discord between them and the Commons; and because it is to defend, not only *Lay-Lords* but Bishops, and all the great Officers of the Realm; it is called *Scandalum Magnatum*.

The House of a Peer cannot, in some Cases (as in Search for prohibited Books, for Conventicles, &c.) be entered by Officers of Justice, without a Warrant under the King's own Hand, and the Hands of six of his Privy Council, whereof four to be Peers of the Realm.

No Peer can be assessed towards the Standing Militia, but by six or more of themselves.

The Law allowing any one of the Commonalty to be arraigned for Felony or Treason, *in favorem vite*, to challenge thirty-five of his Jury without shewing Cause; yet allows not a Peer of the Realm to challenge any of his Jury, or to put any of them to their Oath, the Law presuming, that they being all Peers of the Realm, and judging upon their Honour, cannot be guilty of Falshood, Favour, or Malice; though perhaps the Law sometimes may be mistaken.

All Peers of the Realm have a Privilege of qualifying a certain Number of Chaplains, who after a Dispensation from the Archbishop (if to him it seems good, and the same ratified under the Great Seal of *England*) may hold a Plurality of Benefices with *Cure of Souls*; in this Manner every Duke may qualify six Chaplains, every Marquis and Earl five a-piece, every Viscount four, and every Baron three.

A Peer of the Realm may retain six Aliens born, whereas another may retain not above four.

In case of Amercements of the Peers of the Realm for *Nonfuits*, or other Judgments, a Duke is to be amerced only ten Pounds; and all under, only five Pounds; and this to be done by their Peers, according to *Magna Charta*, although it is often done now by the King's Justices, instead of their Peers.

The Estates of all Peers of the Realm being judged, in the Eye of the Law, to be sufficient at all Times to satisfy all Debts and Damages, Satisfaction is to be sought by Execution taken forth upon their Land and Goods, and not by Attachments, Imprisonments of their Persons, nor by *Exigents*, or *Capias utlegatum*.

There are other Privileges belonging to the Peers of *England*, as eight Tuns of Wine, Custom-free, to every Earl, and to the rest proportionable, &c.

Note, That notwithstanding these great Privileges belonging to the Nobility of *England*, yet the greatest of them (no, not the Brother, or Son of the King) never had the Privilege of the Grandees of *Spain*, to be covered in the King's Presence; nor ever had that high Privilege of the Nobility of *France*, whose *domain Lands*, and their *Dependants* holding them, are exempted from all Contributions and *Tailles*, by which Favour they are tied to their King, and so enabled to serve him, that though there have been Rebellions in the Kingdom, yet seldom of long Continuance, and never prosperous; whereas the highest-born Subject in *England* has herein no more Privilege than the meanest Ploughman.

Touching the Places and Precedences among the Peers of *England*, it is to be observed, that (after the King and Princes of the Blood, *viz.* the Sons, Grandsons, Brothers, Uncles, or Nephews of the King, and no further) Dukes, among the Nobility, have the first Place, then Marquisses, Dukes eldest Sons, Earls, Marquisses eldest Sons, Dukes younger Sons, Viscounts, Earls eldest Sons, Marquisses younger Sons, Barons, Viscounts eldest Sons, Earls younger Sons, Barons eldest Sons, Viscounts younger Sons.

Note, That it was decreed by King *James I.* that the younger Sons of Barons and Viscounts should yield Place and Precedence to all Knights of the Garter, *quatenus tales*, and to all Privy Counsellors, Master of the Wards, Chancellor, and Under-Treasurer of the Exchequer, Chancellor of the Duchy, Chief Justice

Justice of the King's Bench, Master of the Rolls, Chief-Justice of the Common Pleas, Chief-Baron of the Exchequer; and all other Judges and Barons of the Degree of the Coif of the said Courts, and that by reason of their honourable Order and Employment; and also to all *Bannerets* made under the King's Banner or Standard displayed in an Army Royal in open War, and the King personally present.

Note, also, That all Nobles of the same Degree, take Place according to the Seniority of their Creation. But the Princes of the Blood, the great Officers of the Realm, and the Bishops are to precede, according to an Act of Parliament, 31 *Henry VIII.* The Lord Chancellor, Lord Treasurer, Lord President of the King's Council, Lord Privy Seal; these being Barons, or above, shall in Parliament sit above all Dukes, except the Son, Brother, or Nephew of the King. The Lord High Steward of *England* is not here named, because it was not intended that he should not continue beyond the Occasion, for which he should be made. Next has Place the Lord Great Chamberlain of *England*, then the Lord High Constable, the Earl Marshal, the Lord High Admiral, Lord Steward of the King's Household, Lord Chamberlain of the King's Household. Those shall sit after the Lord Privy Seal, above all of their Degree only. And if the King's principal Secretary be a Baron, he takes Place of all Barons, that are not of the Offices before-mentioned; but if he be a Viscount, or higher Degree, he shall take Place only according to his Degree. Also, if the King's Secretary be a Bishop, as antiently was usual; he takes Place next to the Bishop of *Winchester*, before all other Bishops, who have none of the Offices aforesaid.

All Dukes, Marquesses, Earls, Viscounts, and Barons, having none of the said Offices, shall take Place according to the Antiquity of their Creation.

Note, That there are certain Marks of State that belong to each Degree among the *Nobility*, which they may practise, or not practise at Pleasure. A Duke may have in all Places, out of the King's Presence, a Cloth of Estate hanging down, within half a Yard of the Ground; so may his Dutches, and her Train borne up by a Barons; and no Earl to wash with a Duke, unless the Duke permits him. A Marquis may have a Cloth of Estate reaching within a Yard of the Ground, and that in all Places out of the Presence of the King, or a Duke; and his Marchioness to have her Train borne up by a Knight's Wife; and no Viscount to wash with a Marquis, but at his Pleasure. An Earl also may have a Cloth of Estate, without Pendants, and fringed only; and a Countess may have her Train borne by a Gentlewoman, out of the Presence of her Superiors, and in their Presence by a Gentleman.

All Dukes eldest Sons are born as Marquesses, and the youngest as Lords, with the Addition of their Christian Names, as Lord *Thomas*, Lord *John*, &c.

A Marquis's eldest Son is called Lord of a Place, and the youngest Sons, as Lord *Thomas*, Lord *John*, &c.

An Earl's eldest Son is born as a Viscount, and shall go as a Viscount, and shall have as many Powdrings as a Viscount; so their younger Sons are said to be born as Barons, but shall go after all Barons, and before all Baronets.

An Earl's eldest Son is called Lord of a Place, and all his Daughters Ladies; but his youngest Sons are not Lords.

A Viscount's eldest Son is no Lord, nor his Daughters Ladies, and therefore the eldest Son and the eldest Daughter of the first Viscount of *England*, is said to be the first Gentleman and Gentlewoman without a Title in *England*; yet a Viscount's eldest Son is said to be born as a Baron.

All Sorts of Persons in *England*, under the Degree of a Baron, are called the *Commons* of *England*, including the Orders of Knights, Esquires, Gentlemen, the Sons of the Nobility, &c.

Knight, properly signifies a Person, who for his Virtue and martial Prowess, is by the King raised above

the Rank of Gentlemen into an higher Class of Dignity and Honour.

Note, That the Word *Knight*, in its original German *Knecht*, signifies a Servant; and has since been used for a Soldier, or Man of War.—There is but one Instance among the *English*, where Knight is used in the first Sense, and that is in *Knight of the Shire*, who properly serves in Parliament for such a County. In the *Latin*, *French*, *Italian*, *Spanish*, and *Dutch* Languages, Knight is expressed by a Word, which properly signifies a *Horseman*, as being usually employed on Horseback. Indeed the common Law of *England* calls them *Milites*, Soldiers, because they usually held Lands in Knight-Service, to serve the King as Soldiers in his Wars; in which Sense the Word *Miles* was used *pro vassallo*.

Knighthood, was the first Degree of Honour in the antient Armies, and was conferred with a great deal of Ceremony on those who had distinguished themselves by some notable Exploits in Arms. They were originally said to be adopted, which we now call *dubb'd*, as being supposed in some measure the Sons of him who knighted them.

The Ceremonies at the Creation of a Knight have been various: The principal were, a Box on the Ear, and a Stroke with a Sword on the Shoulders; then they put on him a Shoulder-Belt, and gilt Sword, Spurs, and other military Accoutrements; after which, being armed as a Knight, he walks in great Pomp to the Church.

The Manner of making a Knight in *England*, is described by *Camden* in a few Words; *Qui Equestrem dignitatem suscipit, flexis genibus leviter in humero percutitur, Princeps his verbis affatur, sus, vel sis Chevalier au nom de Dieu, surge, vel sis eques in nomine Dei; Rise, or be Knight in the Name of God.*

There are several Kinds of Knights in this Sense, viz. *Knights-Bachelor*, *Knights-Bannerets*, and in *England* *Knights-Baronets*.

Knights-Bachelor, were those, who though they had attained to Knighthood, were not rich enough, or had not a sufficient Number of Vassals to have their Banner carried before them in Battle, but were obliged to fight under the Banner of another.

At present they are called *Equites Aurati*, from the gilt Spurs that are put on them at the Time of their Creation. The Dignity was at first confined to military Men, but afterwards was conferred on Men of the long Robe.

Knights Bannerets, is an antient Order of Knights, or feudal Lords, who possessing several large Fees, led their Vassals to Battle, under their own Flag or Banner, when summoned thereto by the King.

To be qualified for a Banneret, one must be a Gentleman of Family, and must have a Power to raise a certain Number of armed Men; with Estate enough to subsist, at least, twenty-eight or thirty Men.—This must have been very considerable in those Days, in regard each Man, beside his Servant, had two Horsemen to wait on him, the one armed with a Cross-bow, the other with a Bow and Hatchet.

As he was not allowed to be a Baron, who had not above thirteen Knights-Fees, so he was not admitted to be a Banneret, if he had less than ten.

Banneret, according to *Spelman*, was a middle Order between a Baron and a simple Knight, called sometimes also *Vexillarius Minor*, to distinguish him from the greater, that is, from the Baron, to whom alone properly belonged the *Jus vexilli*, or Privilege of the square Flag.

Hence the Banneret was also called *Banneretus*, quasi *Baro minor*, a Word frequently used by *English* Writers, in the same Sense as *Baneret* was by the *French*; though neither of them occur before the Time of *Edward II.*

Some will have Bannerets to have originally been Persons who had some Portion of a Barony assigned them; and enjoy'd it under the Title of *Baro proximus*, with the same Prerogative as the Baron himself.

Some again find the Origin of Bannerets in *France*; others in *Britanny*; others in *England*.—This last attribute the Institution of Bannerets to *Conan*, Lieutenant of

of *Maximus*, who commanded the *Roman* Legions in *England* under the Empire of *Gratian*, in 383. This General, say they, revolting, divided *England* into forty Cantons, and in these Cantons distributed forty Knights, to whom he gave a Power of assembling, on Occasion, under their several Banners, as many effective Men as were found in their respective Districts; whence they are called *Bannerets*.

However this be, it appears from *Froissart*, &c. that antiently such of the military Men who were rich enough to raise and subsist a Company of armed Men, and had a Right to do so, were called *Bannerets*. Not however, that these Qualifications rendered them Knights but only *Bannerets*; the Appellation of Knight being only added thereto, because they were simple Knights before.

Bannerets were second to none but Knights of the Garter; they were reputed the next Degree below the Nobility; and were allowed to bear Arms with Supporters, which none else may, under the Degree of a Baron. In *France* the Dignity was hereditary, but in *England* it died with the Person who gained it. The Order dwindled on the Institution of Baronets by King *James I.* and at length became extinct. The last Person created *Banneret* was Sir *John Smith*, made so after *Edgehill* Fight, for rescuing the Standard of King *Charles I.*

The Form of the *Banneret's* Creation was this: On a Day of Battle the Candidate presented his Flag to the King, or General, who cutting off the Train, or Skirt thereof, and making it a Square, returned it again, the proper Banner of *Bannerets*; who are hence sometimes called *Knights of the square Flag*.

Note, That in *France* those two Orders of *Knights-Bachelor* and *Knights-Banneret*, have been long since entirely extinct, though all Noblemen who are high and low Justiciaries, stile themselves yet *Chevalier*, *Seigneur*; to these have succeeded the military Orders, with which the King is pleased to honour those who have either signalized themselves in his Armies, or elsewhere in his Service; as I'll explain it in a more particular Manner in my Treatise of *Religious* and *Military Orders* under the Letter O.

Knights Baronet, (which is a Dignity peculiar to the *English* Nation) is a Degree of Honour next beneath a Baron, and above a Knight; having Precedency of all Knights, excepting those of the Garter.

The Dignity of Baronet is given by Patent, and is the lowest Degree of Honour that is hereditary.—The Order was founded by King *James I.* in 1611, when 200 Baronets were created at once; to which Number, by the Patent, they were always to be restrain'd: Tho' it is said there are now four Times that Number.

They had several considerable Privileges given them, with an *Habendum* to them, and their Heirs Male. They were allowed to charge their Coat with the Arms of *Ulster*, which are, in a Field argent a Hand gules; and that upon Condition of their defending the Province of *Ulster*, in *Ireland*, against the Rebels, who then harassed it extremely; to which End, they were each to raise and keep up thirty Soldiers at their own Expence, for three Years; or to pay into the Exchequer a Sum sufficient to do it; which at 8 *d.* a Day per Head, was 1005 *l.* now always remitted them.

Baronets take Place according to the Date of their Patents, by the Terms of which no Honour is to be erected between Barons and Baronets.

The Title, *Sir*, is granted them by a peculiar Clause in their Patents, though they be not dubbed Knights. But both a Baronet and his eldest Son, being of full Age, may claim Knighthood.

Note, That Knight, *Eques*, among the *Romans*, was the second Degree of Nobility, following immediately that of the Senators. At the Time of building the City of *Rome*, the whole Army of *Romulus* consisted of 3000 Foot and 300 Horse; which 300 Horse were the Original of the *Roman Equites*, or Knights. These made the second Order that had Places in the Senate. *Manutius* and *Sigonius* are of Opinion, that besides the Equestrian Order, and these Knights im-

mediately below the Senators, *Romulus* instituted a military Order, whereof the *Roman* Cavalry was composed. But no antient Author takes Notice of any Order of Knighthood instituted on purpose for the War, nor any other Knights but those 300, which, as we have observed, were the first Foundation of the Equestrian Order. The Knights had a Horse kept them at the publick Charge; but when they were taken in among the Senators, they resigned that Privilege to be a Knight. It was necessary they should have a certain Revenue, that their Poverty might not disgrace the Order; and when they failed of the prescribed Revenue, they were expunged out of the List of Knights, and thrust down among the Plebeians. Ten thousand Crowns is computed to have been the Revenue required. The Knights grew so very powerful, that they became a Balance between the Power of the Senate and the People. They neglected the Exercises of War, and betook themselves principally to civil Employments in *Rome*; insomuch that *Pliny* observes, in his Time, they had no longer a Horse kept at the publick Expence. Some say, that the Order of Knights, as distinct from the People, did not begin from the Time of the *Gracchi*; others say, the Privilege was then first granted them, that no Judge should be chosen but out of their Order; some Time after which they took them into the Senate. This however is certain, it was only necessary, and that this intitled them to the Knighthood, without being descended from antient Knights.

Next below the Title of a Knight, and above that of a simple Gentleman, is the Quality of *Esquire*.

The Origin both of the Name and the Thing, *Esquire*, is very dark; the *English* Denomination is confessedly borrowed from the *French*, *Ecuyer*, and that from the Latin *Scutum*, Shield, as some will have it; or as others, from *Scutarius*, or *Scutiger*, Shield-bearer; or from *Scuria*, Stable, or *Equiso*, Groom.

So many different Opinions of the Formation of the Words have given Rise to as many about the primitive Office of *Esquires*; unless, perhaps, the latter has given Occasion to the former.

Pasquier, in his Researches, lib. 2. c. 15. maintains the Title of *Esquire*, *Escuyer*, *Scutarius*, to be very antient. From the Time of the Declension of the *Roman* Empire, he observes, there were two extraordinary Kinds of Soldiery in the *Roman* Army, the one called *Gentiles*, and the other *Scutarii*.

Ammian. Marcellin, l. 14. c. 7. and l. 16. c. 4. speaks of these *Scutarii* as Men of redoubted Prowess, and even deemed invincible. It is added, that *Julian* the Apostate set a mighty Value on those Troops when he was among the *Gauls*; and hence probably it was that the *Gauls*, or perhaps the *Franks*, finding the bravest among the *Roman* Forces, were called *Gentiles*, and *Scutarii*, gave the like Name to the boldest and bravest among themselves; such, according to that curious Antiquary, is the Origin of *Esquire*.

Esquire, however, afterwards came to be used in somewhat different Sense, viz. for a Gentleman who attended a Knight in the Wars, and on other military Occasions, bearing his Shield, *Scutum*, before him (whence he was called *Scutarius*, *Scutiger*, or *Scutifer*) as also his Launce, and other Weapons: Whence his other Appellation usual among us, *Armiger*, q. d. Armour-bearer. And hence likewise it is, that in all our antient Romances, the Hero is constantly attended by a gentle and trusty 'Squire.

After all, the most probable Derivation of *Escuyer*, is not from *Escu*, *Scutum*, as is the common Opinion, but from *Equus*, Horse, the primitive *Esquires* being no other but what the *Latins* call *Equifones*, who had the Care and Intendence of the Equeries, or Stables only.

Be this as it will, the Title of *Esquire*, *Armiger*, as now established among us, is the next below that of a Knight, *Eques*. They who bear the Title are all younger Sons of Noblemen, and the eldest Son of such younger Sons; the eldest Sons of Knights, and their eldest Sons successively; the four *Esquires* of the King's Body, and *Esquires* created by the King, by putting about their Neck a Collar of S S's, and bestowing on them a Pair of

of Silver Spurs. Lastly, divers others in the superior publick Offices, are reputed Esquires, or equal to Esquires, as Sheriffs of Counties, Serjeants at Law, Justices of Peace, Mayors of Towns, Counsellors at Law, Batchelors of Divinity, Law, Physick, &c. though none of them are really so: Lastly the Heads of some antient Families are likewise Esquires by Prescription.

Note, That in *France* the first Degree, next below a Baron, or rather the last Degree of Nobility, is that of *Escuyer*, Esquire; and that Persons, newly made Nobles, take all the Title of *Escuyer*, *Sieur*, &c. *Esquire*, *M.* &c. for the King of *France*, when he makes a Nobleman, seldom or never raises him to a higher Rank. And then he does not enjoy all the Privileges of the Nobility, neither do his Children divide his Estate among them, as Noblemen, but only his Grandchildren.

Next below an Esquire, in *England*, is a *Gentleman*, who is a Person of a noble Birth, or descended of a Family which has long bore Arms.

Note, That the Word is formed of the *French* *Gentilhomme*, or rather of genteel, fine, fashionable, or becoming; and the *Saxon* *Man*, q. d. *Honestus*, or *Honesto loco natus*. The same Signification has the *Italian* *Gentilhuomo*, and the *Spanish* *Hidulgo*, or *Hijo Dalgo*, that is, the Son of Somebody, or of a Person of Note. If we go farther back we shall find Gentleman originally derived from the *Latin*, *Gentilis homo*, which was used among the *Romans* for a Race of noble Persons of the same Name, born of free or ingenuous Parents, and whose Ancestors had never been Slaves, or put to Death by Law. Thus *Cicero*, in his *Topicks*, *Gentiles sunt, qui inter se eodem sunt nomine, ab ingenuis oriundi, quorum majorum nemo servitutem servivit, qui capite non sunt diminuti*, &c. Some hold that it was formed from *Gentile*, i. e. Pagan, and that the antient *Franks*, who conquered *Gaul*, which was then converted to Christianity, were called *Gentiles* by the Natives, as being yet Heathens. Others relate, that towards the Declension of the *Roman* Empire, as recorded by *Amianus Marcellinus*, there were two Companies of brave Soldiers, the one called *Gentilium*, and the other *Scutariorum*; and that it was hence we derived the Name Gentleman and Esquire. This Sentiment is confirmed by *Pasquier*, who supposes the Appellation *Gentiles* and *Escuyers*, to have been transmitted to us from the *Roman* Soldiery; it being to the *Gentiles* and *Scutarii*, who were the bravest of the Soldiery, that the principal Benefices, and Portions of Lands, were assigned. The *Gauls* observing, that during the Em-

pire of the *Romans*, the *Scutarii* and *Gentiles* had the best Tenements or Appointments of all the Soldiers on the Frontiers of the Provinces, became insensibly accustomed to apply the same Names, *Gentilhomme* and *Escuyers*, to such as they found their Kings gave the best Provisions and Appointments to.

In Strictness, *Chamberlayne* observes, a Gentleman is one whose Ancestors have been Freemen, and have owed Obedience to none but their Prince: On which Footing no Man is a Gentleman who is not born so.

Among the *English*, the Term Gentleman is applicable to all above Yeomen; so that Noblemen may be properly called Gentlemen.

In the *English* Statutes, *Gentilis homo* was adjudged a good Addition for a Gentleman, 27 *Ed. III.* the Addition of Knight is very antient, but that of Esquire or Gentleman rare before 1 *Hen. V.*

Note, That what we call *Gentlemen*, *Gentilhommes*, in *France*, are all Noblemen born, except those whom the King is pleased to make such, either for some signal Services, or on any other Consideration, since all Noblemen, of what Rank soever, call themselves *Gentilhommes*, and glory in that Appellation. All others who are not such, let them be every so rich, are all included under the common Appellation of Burghesses; and all accounted Roturiers, i. e. of the third Estate, or *tiers Estat*, as we call it; none of them enjoying any of the Privileges of the Nobility.

Note also, That the Privileges of the lower Nobility, in *England*, are as follows, viz. Knights are excused from Attendance at Court-Leets. By *Magna Charta*, c. 21. they are so freed that no Demesne Cart of theirs may be taken. The Son and Brother of a Knight by Statute Law, are capacitated to hold more than one Benefice for the Cure of Souls. By the Statute, *Prim. Jacob.* it seems that Knights and their Sons (though they cannot spend 10 *l.* per Ann. nor are worth 200 *l.*) may keep Greyhounds, Setting Dogs, or Nets, to take Pheasants or Partridges.

Some Privileges, also, belong to Gentlemen. Antiently, if an ignoble Person did strike a Gentleman in *England*, he was to lose his Hand. A Gentleman, by *Stat. quint. Elizab.* may not be compelled to serve in Husbandry. The Child of a Gentleman brought up to sing, cannot be taken without the Parents and Friends Consent, to serve in the King's Chapel, as others may. The Horse of a Gentleman may not be taken to ride Post, &c.

O P T I C K S.

OPTICKS, according to Sir *Isaac Newton*, is a mixed mathematical Science, which explains the Manner wherein Vision is performed in the Eye; treats of Sight in the general; gives the Reason of the several Modifications or Alterations which the Rays of Light undergoes in the Eye; and shews why Objects appear sometimes greater, sometimes smaller, sometimes more distinct, sometimes more confused, sometimes nearer, and sometimes more remote.

Note, That to proceed in the same Order I have observed in all my other Treatises, I'll begin this by treating of Sight in general; and previously to it, by an exact Description of several Parts which compose the Eye; that thereby the Reader may understand better the Manner wherein the Vision is performed, and account more pertinently for the several Modifications or Alterations which the Rays of Light undergo in the Eye; then I'll pass to *Catoptricks*, and from thence to *Dioptricks*, leaving *Perspective* for a Treatise apart.

SIGHT is of such Necessity and Excellence, that every Body would rather chuse to be deprived of any other of their Senses, than that of Sight. For with its Assistance,

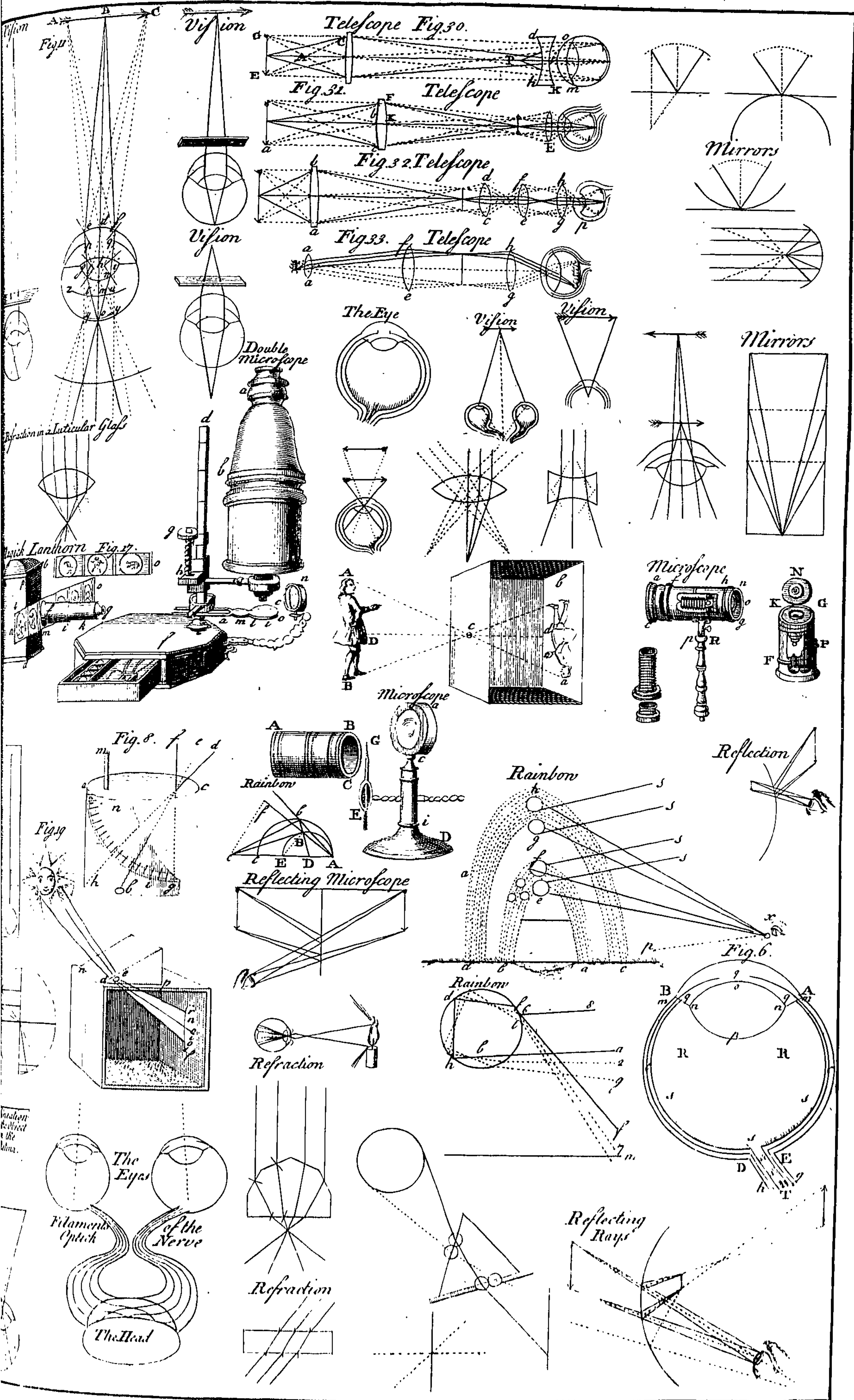
the Body is directed by the Soul, the great and beautiful Fabrick of this aspectable World is known; and the Things invisible render'd conspicuous by the visible.

The Organ of Sight is the Eye, or rather the Eyes; since Nature has presented us with two; that if by some Misfortune or other, one should fail us, the other remaining should discharge the Office of both. But the Author of Nature has provided for the Security of both, by placing them under the Forehead, on the Sides of the Nose, in two Orbits, dug in the Bones of the Cranium, that in those osseous Seats, they may be the better shelter'd against all foreign Accidents. To these Orbits, he was pleased to add, for a still greater Security, two Eye-Lids, or Veils, to cover the Eye, and defend it from Dust, Smoak, and all other Things which could hurt it.

There occurs in the Eye-Lids several small Glands, which with the Humour contained therein, water the Eye; but more particularly in the great Angle, called *Canthus*, there is the lachrymal Gland, whence Tears flow, excited to it, either by an Excess of Sorrow, or by some acrimonious Humour, or some sharp Wind affecting that Gland.

In the Orbit are found six Muscles, applied to the Me-

OPTICKS.



tion of the Eye. The first of them draws the Eye upwards, and therefore is called *Elevator* or *Superbus*. The second, which is opposite to it, casts it down, whence it is called *Deprimens*, or *Humilis*. The third, placed in the internal Angle, or great *Canthus*, draws the Eye towards the Nose, whence it is called *Adducens* and *Potator*. The fourth draws the Eye towards the little or external *Canthus*, and is for that Reason called *Abducens* or *Indigator*. These four Muscles are called *Rekti* or straight Muscles.

The two other Muscles are the *Obliqui*, which environ the Eye, and move it obliquely.

While the oblique Muscles act in Concert, and with an equal Strength, the Sight is strait; but if one of them be stronger than the other, then the oblique Motion is bad; but to prevent, as much as possible, that Deformity in the oblique Motion of the Eye, cautious Nature has placed at the Root of the Nose, a certain perforated Cartilage, called the *Troclea*, whereby that deformous Motion is moderated.

As to the particular Structure of the Eye itself; it is composed of three proper Membranes, and of so many Humours. I call them *proper Membranes*, and not *common*, as is the *Adnata*, called by *Hippocrates* and *Galen*, the *White of the Eye*; and which, because it joins the Eye with the Orbit, and inward Bones, is called the *Conjunctive*, and is thought to be propagated from the *Pericranium*.

The first *proper Membrane*, is said to be expanded round the Ball of the Eye; the hind-Part thereof, A F, is called *Sclerotica*, or hard; and the Anterior, viz. A B, *Cornea*, because transparent like Horn. Fig. 6.

The second, which is thinner, proceeds from the *Pia Mater*, and is commonly called in its posterior Parts C C *Choroides*, either because it contains the Humours of the Eye, in very near the same Manner the *Chorion* contains the Foetus, or because the small Vessels it is cover'd with, are disposed in Form of a Chorus; and *Uvea*, in its Anterior, Q I I Q; thus called, because it is transparent like a Grain of a Grape.

The Perforation of the *Uvea*, II. is called the *Pupil*, or *Apple of the Eye*; which by Means of muscular Fibres, is sometimes contracted, when too much Light offends the Eye; and sometimes dilated, when there is but a moderate Light. Those muscular Fibres being disposed round the Pupil, in a circular Manner, are called the *Iris*.

The third Membrane, or Tunick S S S, is the *Retina*, so called as resembling a Net, and covering only the Fund or Bottom of the Eye, opposite to the Sight. This Membrane derives from the medullary Substance, T S S S, of the *Optick Nerve*; and is considered as the proper Organ of the Sight.

Three Humours are conspicuous in the Eye, and inclosed between these Tunicks, viz. 1. The *Aqueous*, a limpid transparent Humour, situated in the fore-Part of the Eye, immediately under the *Cornea*, and occasioning its Protuberance.

The *Crystalline*, situated immediately under the aqueous, behind the *Uvea*, opposite to the Pupil.

3. The *vitrous* or *glassy Humour*, which fills all the hind-Part of the Cavity of the Globe; and is that which gives the spherical Figure to the Eye. On its back-Part is the *Retina* spread.

Some Authors finding these Humours covered with proper Membranes, have given distinct Names to them, as the *aqueous*, *crystalline*, and *vitrous Tunicks*; but these being only Productions of the other Coats above-mentioned, the Distinction is not much regarded.

These previously observed with Respect to the Organ of Sight, I'll pass to the Explication of *Vision*; which is the Act of seeing, or perceiving Objects by the Organ of Sight.

Vision, is very well defined to be a Sensation, whereby, from a certain Motion of the *Optick Nerve*, made in the Bottom of the Eye, by the Rays of Light emitted or reflected from Objects, and hence conveyed to the common Sensory in the Brain, the Mind perceives the luminous Object; its Quality, Quantity, Figure, &c.

The Phenomena of *Vision*, the Causes thereof, and the Manner wherein it is effected, make one of the greatest and most important Articles of the whole System

of natural Knowledge. Indeed a great Part of the physical, mathematical, and anatomical Discoveries of the Moderns terminate here, and only tend to set the Business of *Vision* in a clearer Light.

Hitherto refers what Sir *Isaac Newton*, and others, have discovered of the Nature of Light and Colours, the Laws of Inflection, Reflection, and Refraction of the Rays; the Structure of the Eye, particularly the *Retina*, and *Optick Nerves*, &c.

The better to understand this Article, we must carefully examine, previously to all other Things, the Nature of *Light* and *Colours*, which is the Medium, or Vehicle, whereby Objects are carried to the Eye.

LIGHT, is that Sensation occasioned in the Mind, by the View of luminous Bodies; or that Property in Bodies, whereby they are fitted to excite those Sensations in us.

Light is also used to denote a certain Action of the luminous Body, on a Medium between it and the Eye; by Means whereof, some suppose the one to act on the other.

This they call *secondary* or *derivative Light*; to distinguish it from that of luminous Bodies, which is called *primary* or *minute*.

Aristotle explains the Nature of *Light*, by supposing some Bodies to be transparent, as Air, Water, Ice, &c. But since, in the Night-time, we do not see any Thing through those Bodies, he says, they are only transparent potentially; whereas in the Day they become really and actually transparent: And since it is *Light* alone that can reduce that Power into Act, he defines *Light* to be the Act of a transparent Body, consider'd as such. He adds that *Light* is no Fire, nor is it any Thing bodily, radiating from the luminous Body, and transmitted thro' the transparent one; but the mere Presence of Fire, or some other luminous Body, at the transparent one.

This is *Aristotle's* Doctrine of *Light*, which his Followers mistaking, have foisted on him another, very different; making *Light* and *Colours* to be Qualities of the luminous and colour'd Bodies themselves, and in all Respects like those Sensations which they occasion in us: Adding, that Things lucid, or colour'd, could not produce any Sensations in us, unless they had something similar in themselves, since *Nihil dat quod in se non habet*.

But the Sophism is apparent; for we find, that a Needle, in pricking the Flesh, gives us Pain, which no Body ever imagined to exist in the Needle. But that it is not necessary there should be any Similitude between the Quality of the Object, and the Sensation it produces, appears still more evident from a Glass Prism, which is formed to exhibit blue, yellow, red, and other Colours, extremely vivid; and yet no Body will say there is any Thing in the Glass Prism, like those Sensations.

The *Cartesians* have refined considerably on this Notion; and own, that *Light*, as it exists in the luminous Body, is nothing but a Power or Faculty of exciting in us a very clear and vivid Sensation; adding, that what is required to the Perception of *Light*, is, that we be so formed, as to be capable of such Sensations; that in the hidden Pores of the transparent Bodies, there be a certain subtle Matter, which, by Reason of its exceeding Smallness, may penetrate even Glass, and yet be strong enough to shake certain Capillaments at the Bottom of the Eye; and lastly, that this Matter be impelled by the luminous Body, so as to move the Organ of Sight.

Primary *Light*, therefore, they say, consists in a certain Motion of the Particles of the luminous Bodies, whereby they are enabled to propel, every Way, the *Materia Subtilis*, lodged in the Pores of transparent Bodies; and secondary or derivative *Light*, in a *Conatus* to Motion, or an Inclination of that Matter, to recede from the Center of the luminous Body in right Lines.

Father *Malebranche* explains the Nature of *Light* from a supposed Analogy between it and Sound; the latter, it is allowed, is produced by the Vibrations of the insensible Parts of the sonorous Body: Which Vibrations, if they be greater or less, that is, if they run through greater or less Arches of the same Circle, are still performed in the same Time, and the Sounds produced by them, only differ in greater or less Degree of Strength; but if there be a greater Number of Vibrations, in the same

same Time, in one sonorous Body, than in another, these being closer, become of a different Kind: And thus their Sounds also differ, forming what we call different Tunes or Notes; the quick Vibrations forming the acute, and the slower the grave Notes.

Thus he supposes it to be with the *Light* and Colours: All the Parts of a luminous Body are in a rapid Motion, which, by very quick Pulses, is constantly compressing the subtle Matter, between the luminous Body and the Eye, and excites Vibrations of Pressions. As these Vibrations are greater, the Body appears more luminous; and as they are more quick, or more slow, the Body is of this or that Colour.

This Hypothesis, how ingenious soever, is entirely disregarded by the *Newtonians*; who say, that the primary *Light*, Father *Malebranche* tells us of, consists wholly in a certain Motion of the Particles of the lucid Body, whereby they do not propel any fictitious Matter, supposed to be lodged in the hidden Pores of transparent Bodies; but throw off from the luminous Body, certain very small Particles, which are emitted every Way with great Force: And that the secondary or derivative *Light* consists, not in a *Conatus*, but a real Motion of these Particles, receding every Way from the luminous Body, in right Lines, and with an incredible Velocity.

For, say they, if *Light* consisted in a mere Pressure, or Pulse, it would be propagated to all Distances, in the same Instant of Time; the contrary of which appears, from the Phenomena of the Eclipses of *Jupiter's* Satellites, whose Immersions, as the Earth approaches towards *Jupiter*, are found to anticipate somewhat on the true Time, and to commence sooner; and again, as the Earth retires from *Jupiter*, their Emergences, which alone, in that Case observed, happen later and later, or lose Time: Deviating thus, very considerably on either Side, from the true Time marked by the Tables.

This was first observed by *M. Ramer*, and since by other Astronomers; the Reason of which is not owing to any Eccentricity; but does apparently follow from this, that the *Light* of the Sun, reflected from the Satellites, has further to travel, e'er it reaches the Eye, in the one Case, than in the other, by a Space equal to the Diameter of the Earth's annual Orbit.

Light, therefore, according to this Sentiment, like other real Bodies, do not move instantaneously, but in Time. Sir *Isaac Newton* has shewn, that the *Light* of the Sun is near seven Minutes in its Passage to the Earth, which is the Space of 70,000,000 Miles; a Velocity 10,000,000 greater than that wherewith a Ball flies out of the Mouth of a Cannon.

They say, further, that if *Light* were not a Body, but consisted in a mere Pulsion or Pressure, it would never be propagated in right Lines, but would be continually inflected *ad umbram*. Thus Sir *Isaac Newton*, 'A Pressure on a fluid Medium (*i. e.* a Motion propagated by such a Medium) beyond any Obstacle, which impedes any Part of its Motion, cannot be propagated in right Lines, but will be always inflecting and disposing itself every Way, to the quiescent Medium beyond that Obstacle. The Power of Gravity tends downwards, but the Pressure of Water rising from it, tends every Way with an equal Force, and is propagated with equal Ease, and equal Strength in Curves, as in strait Lines. Waves on the Surface of the Water, gliding by the Extremes of any very large Obstacle, inflect, and dilate themselves, still diffusing gradually into the quiescent Water, beyond that Obstacle. The Waves, Pulses, or Vibrations of the Air, wherein Sound consists, are manifestly inflected; though not so considerably as the Waves of Water; and Sounds are propagated with equal Ease, through crossed Tubes, and through strait Lines; but *Light* was never known to move in any Curve, nor to inflect itself *ad umbram*.' Whence it is concluded by Sir *Isaac's* Disciples, that the Rays of *Light*, are small Corpuscles, emitted with exceeding Celerity from the luminous Body. As to the Force wherewith these Corpuscles are emitted, so as to enable them to move at the inconceivable Rate of 10,000,000 Miles in a Minute, hear the same Author: 'Among Bodies of the same Kind and Virtue, by how much any one is smaller, by so much is its attractive Power greater, in Proportion to its Bulk. This Power we find stronger

' in small Magnets, than in large ones, Regard being had to the Difference of their Weights; and the Reason is, that the Particles of small Magnets being nearer each other, more easily unite their Forces intimately together, and act conjunctly. For the same Reason, the Rays of *Light*, being of all other Bodies the most minute, it may be expected, that their attractive Powers should be, of all others, the strongest; and how strong in Effect they are, may be gathered from the following Rules. The Attraction of a Ray of *Light*, according to the Quantity of its Matter, in a Ratio, compounded of the Velocity of the Ray of *Light*, to the Velocity of that projected Body; provided, however, the Inclination of the Ray, to the refracting Surface, be the same with that of the projected Body to the Horizon. From which Proportion I gather, that the Attraction of the Rays of *Light*, is above 1,000,000,000,000 Times greater; that the Gravity of Bodies, on the Surface of the Earth, in Proportion to the Quantity of Matter in each, if the *Light* passes from the Sun to the Earth in the Space of seven Minutes. But now, as in Algebra, where affirmative Quantities cease, there negative ones begin; so in Mechanics, where Attraction ceases, there the repelling Power must succeed: Therefore a Ray of *Light*, as soon as it is cast off from the luminous Body, by the vibrating Motion of its Parts, and is got out of the Sphere of its Attraction, is propelled with an immense Velocity.'

The wonderful Divisibility of the Parts of Matter, is no where more apparent, than in the Minuteness of the Particles of *Light*: Dr. *Niewentit* has computed, that an Inch of Candle, when converted to *Light*, becomes divided into 269617040 Parts, with 40 Cyphers annexed; at which Rate there must issue out of it, when burning 418660, with 39 Cyphers more, Particles in the second of a Minute, vastly more than a thousand Times a thousand Million Times the Number of Sand the whole Earth can contain; reckoning 10 Inches to a Foot, and that 100 Sands are equal to an Inch.

The Expansion, or Extension of any Portion of *Light*, is thought inconceivable; Dr. *Hook* shews, it is as unlimited as the Universe; proving it from the immense Distance of some of the fixed Stars; the *Light* whereof becomes sensible to the Eye by Means of a Telescope; nor, adds he, is it only the great Bodies of the Sun and Stars, that are thus able to disperse their *Light* through the vast Expanse of the Universe; but the smallest Spark of a lucid Body must do the same, even the smallest Globule, struck from a Steel by a Flint.

Dr. *Gravesand* asserts, a lucid Body to be that, which emits or gives Fire a Motion in right Lines; and makes the Difference between *Light* and Heat to consist in this, that to produce the former, the fiery Particles must enter the Eye, in a rectilinear Motion, which is not required in the latter: On the contrary, an irregular Motion seems more proper for it, as appears from the Rays coming directly from the Sun, to the Tops of Mountains, which have not near that Effect with those in the Valleys, agitated with an irregular Motion, by several Reflections.

Whether or no there be always *Light* where there is Fire, is disputed among Authors; as also whether there be any luminous Body without Heat; Heat being a Motion that may be infinitely diminished, and *Light* a Matter that may be infinitely rare: To which we may add, that no Heat is sensible to us, unless it be more intense than that of our Organs of Sense.

Sir *Isaac Newton* observes, that Bodies and *Light* act mutually on one another; Bodies on *Light* in emitting, reflecting, refracting, and inflecting it; and *Light* on Bodies, by heating them, and putting their Parts into a vibrating Motion, wherein Heat principally consists. For all fixed Bodies, he observes, when heated beyond a certain Degree, do emit *Light* and shine; which Shining, &c. appears to be owing to the vibrating Motion of their Parts; and all Bodies abounding in earthy and sulphureous Particles, if sufficiently agitated, emit *Light*, which Way soever that Agitation be effected. Thus Sea-Water shines in a Storm, Quicksilver, when shaken in vacuo, Cats, or Horses, when rubbed in the Dark; and Wood, Fish, and Flesh, when putrified.

M. Harelsbee has furnished us with a great Variety of

of Instances of the artificial Production of *Light*, naturally not luminous; as of Amber rubbed on Woollen Cloth *in vacuo*, of Glass on Woollen, of Glass on Glass, of Oyster-Shells on Woollen, and of Woollen on Woollen, all *in vacuo*.

On the several Experiments hereof, he makes the following Reflections; that different Sorts of Bodies afford remarkably different Kinds of *Light*, different both in Colour and in Force: That the Effects of an Attrition are various, according to the different Proportions and Managements of the Bodies that are to endure it; and that Bodies which have yielded a particular *Light*, may be brought by Friction, to yield no more of that *Light*.

M. Bernoulli found by Experiment, that Mercury amalgamated with Tin, and rubbed on Glass, did it still in a greater Degree: But that of all others, the most exquisite *Light* was that produced by the Attrition of a Diamond; being equally vivid with that of a burning Coal, briskly agitated by the Bellows.

Mr. Boyle tells us of a Piece of shining rotten Wood, which, upon exhausting the Air from it was extinguished; but upon its Re-Admission, seemed to come to Life again, and shone as before: Being no doubt a real Flame, and like other Flames, not to be preserved without Air.

That the Particles of *Light* are attracted by other Bodies, is evident, from innumerable Experiments. This Phenomena was first observed by Sir Isaac Newton, who found by repeated Trials, that the Rays of *Light*, in their Passage near the Edges of Bodies, whether opaque or transparent, as Pieces of Metal, the Edges of Knives, broken Glasses, &c. are diverted out of the right Lines, and always inflected or bent towards those Bodies.

This Action of Bodies on *Light*, is found to exert itself at a sensible Distance, though it always increases as the Distance is diminished; as appears very sensible in the Passage of a Ray between the Edges of two thin Plates at different Apertures; in which there is something very peculiar; the Attraction of one Edge being increased as the other is brought nearer to it. The Rays of *Light* in their Passage out of Glass into *Vacuum*, are not only inflected towards the Glass, but if they fall too obliquely, will revert back again to the Glass, and be totally reflected.

The Cause of which Reflection cannot be attributed to any Resistance of the *Vacuum*, but must be entirely owing to some Force or Power in the Glass, which attracts or draws back the Rays, as they were passing into the *Vacuum*. And this appears farther from hence, that if you wet the posterior Surface of the Glass with Water, Oil, Honey, or a Solution of Quick-Silver, then the Rays, which would otherwise have been reflected, will pass into and through that Liquor: Which shews, that the Rays are not reflected till they come to that posterior Surface of the Glass, nor even till they begin to go out of it; for if at their going out they fall into any of the foresaid Mediums, they will not then be reflected, but persist in their former Course, the Attraction of the Glass being in this Case counter-balanced by that of the Liquor.

From this mutual Attraction between the Particles of *Light* and other Bodies, arise two other grand Phenomena, which we call the *Reflection* and *Refraction* of *Light*: We know, that the Determination of a Body in Motion, is changed by the Interposition of another Body in its Way: Thus *Light* impinging on the Surface of solid Bodies, should be turned out of its Course, and beaten back or reflected, so as, like other falling Bodies, to make the Angle of its Reflections, equal to that of Incidence.

This is found by Experience, *Light* does; and yet the Cause of this Effect is different from that just now assigned: The Rays of *Light* are not reflected by striking on every Part of the reflecting Bodies, but by some Power equally diffused throughout the whole Surface of the Body, whereby it acts on the *Light*, either attracting or repelling it without Contact: By which same Power, in other Circumstances, the Rays are refracted; and by which also the Rays are first emitted from the luminous Body: As is abundantly proved by great Variety of Arguments, by Sir Isaac Newton; which are as follows:

1. Because the Surfaces of polished Glasses, which

to the Eye appears smooth, are yet in Reality very rugged and uneven; (Polishing being nothing but grating, scratching, and breaking off the coarser Protuberances, by Means of Sand, Glass, Putty, or Tripoli) if the Rays of *Light*, therefore, were reflected by striking on the solid Parts of the Glass, the Reflections would never be so accurate as we find they are; but the Rays would even be as much scatter'd by the most polished Glass, as by the roughest. It remains, therefore, a Problem, how Glass, polished by fretting Substances, can reflect *Light* so regularly as it does, which Problem is scarce otherwise to be solved than by saying, that the Reflection of a Ray is effected, not by a single Point of the reflecting Body, but by some Power of the whole Body, evenly diffused all over its Surface, and by which it acts on a Ray without immediate Contact.

2. If the Colours separated by a Prism, placed at the Entrance of a Beam of *Light*, into a darken'd Room, be successively cast on a second Prism, placed at a greater Distance from the former, in such Manner, as that they all fall alike, or with an equal Obliquity upon it; the second Prism may be so inclined to the incident Rays, that those which are of a blue Colour, shall be all reflected by it; and yet those of a red Colour pretty copiously transmitted. Now if the Reflection were caused by the Parts of the Air, or Glass, we would ask why, at the same Obliquity of Incidence, the blue should only impinge on those Parts so as to be all reflected, and yet the red finds Pores enough, to be in a great Measure transmitted?

3. Where two Glasses touch one another, there is no sensible Reflection, and yet we see no Reason why the Rays should not impinge on the Parts of the Glass, as much when contiguous to other Glass, as when contiguous to Air.

4. When the Top of a Water-Bubble, by the continual subsiding, and exhaling of the Water, grows very thin, there is such a little, and almost insensible Quantity of *Light* reflected from it, that it appears intensely black; whereas round about that black Spot, where the Water is thicker, the Reflection is so strong as to make the Water seem very white. Nor is it only at the least Thickness of thin Plates or Bubbles, that there is no manifest Reflection, but at many other Thicknesses, gradually greater and greater. For in one of our Author's Observations, the Rays of the same Colour were by Turns transmitted at one Thickness, and reflected at another Thickness for an undeterminate Number of Successions; and yet in the Superficies of the thin Body, where it is of one Thickness, there are as many other Parts for Rays to impinge on, as where it is of any other Thickness.

5. If red and blue Rays, separated by a Prism, fall successively on a thin Plate of any pellucid Matter, whose Thickness increases in continual Proportion (such as a Plate of Air between two Glasses, the one Plane, and the other a little Convex) the same Part reflects all the Rays of one Colour, and transmits all those of the other; but in different Parts, will reflect the Rays of one and the same Colour, at one Thickness, and transmit them at another; and thus alternately, and *in infinitum*. Now it can never be imagined, that at one Place, the Rays which, for Instance, exhibit a blue Colour, should have the Fortune to strike on the solid Parts; and those which exhibit a red to hit on the void Parts of the Body; and at another Place, where the Body is either a little thicker, or a little thinner, that on the contrary the blue should hit on the Pores, and the red upon the solid Parts.

6. In the Passage of *Light* out of Glass into Air, there is a Reflection as strong as in its Passage out of Air into Glass, or rather a little stronger, and by many Degrees stronger than in its Passage out of Glass into Water.

Now it seems improbable that Air should have more reflecting Parts than Water or Glass; but if that should be supposed, yet it will avail nothing; for a Reflection is as strong, or stronger, when the Air is drawn from the Glass by the Air-Pump, as when it is adjacent to it. If any should here object, on Des Cartes's Hypothesis, that though the Air be drawn, there is a subtle Matter remaining to supply its Place, which being of a denser Kind, is better fitted for the Reflection of *Light*, than any

any other Body, the *Newtonians* pretend that the following Experiment does evidently convince that Reasoning of Falſity.

7. If *Light* in its Paſſage out of Glaſs into Air, ſtrike more obliquely than at one Angle of 40 or 41 Degrees, it is wholly *reflected*, if leſs obliquely it is in great meaſure tranſmitted. Now it is not to be imagined, that *Light* at one Degree of Obliquity ſhould meet with Pores enough in the Air to tranſmit the greater Part of it, and at another Degree ſhould meet with nothing but Parts to reflect it wholly, eſpecially conſidering that in its Paſſage out of Air into Glaſs, how oblique ſoever be its Incidence, it finds Pores enough in the Glaſs to tranſmit a great Part of it. If any ſuppoſe that it is not reflected by the Air, but by the utmoſt ſuperficial Parts of the Glaſs, there is ſtill the ſame Difficulty: Beſides, that ſuch a Suppoſition is unintelligible, and will alſo appear to be falſe, by applying Water behind ſome Part of the Glaſs inſtead of Air: For ſo in a convenient Obliquity of the Rays, ſuppoſe of 45 or 46 Degrees, at which they are all reflected where the Air is adjacent to the Glaſs, they ſhall be in great meaſure tranſmitted where the Water is adjacent to it; which argues, that their Reflection or Tranſmiſſion depends on the Conſtitution of the Air and Water behind the Glaſs, and not on the ſtriking of the Rays upon the Parts of the Glaſs; the Rays not being reflected until they have reached the laſt Parts of the Surface, and are begun to go out. For if in going out they fall upon a Surface of Oil and Water, they proceed; the Attraction of the Glaſs being ballanced by an equal Force the contrary Way, and prevented from having its Effect, by the Attraction of the Liquor adhering to it: But if the Rays in paſſing out of this laſt Surface fall into a Vacuum which has no Attraction, or into Air which has but little, not enough to counterballance the Effect of the Glaſs; in this Caſe the Attraction of the Glaſs draws them back and reflects them.

This will appear ſtill more evident, ſay they, by laying two Glaſs-ſprisms, or the object Glaſſes of two Telescopes, the one plain, and the other a little convex, upon each other, ſo as they may neither touch, nor yet be too far a-part, will be tranſmitted above 1000000 Part of an Inch a-part, will be tranſmitted through the Surface, and through the Air, or Vacuum between the Glaſſes, and paſs into the ſecond Glaſs; but if the ſecond Glaſs be taken away, then the *Light* paſſing out of the ſecond Surface of the firſt Glaſs into the Air or Vacuum will not proceed, but return into the firſt Glaſs and be reflected.

Whence it follows, that the Rays are drawn back again by ſome Force in the firſt Glaſs, there being nothing elſe to occaſion their Return. And hence too it follows, that the *Reflection* is not effected, ſay they, by any ſubtle Matter, contiguous to the hind Surface, according to the Principles of *Des Cartes*; ſince that Matter ought to reflect them when the Glaſſes were nearly contiguous, as well as when the ſecond Glaſs is quite removed.

Laſtly, if it be asked how ſome Rays come to be reflected, and others tranſmitted; and why they are not all alike reflected, ſuppoſing the *Reflection* owing to the Action of the whole Surface? The ſame Authors ſhew, that there are both in the Rays of *Light*, and in the Bodies themſelves, certain Vibrations (or ſome ſuch Property) impreſſed on the Rays by the Action, either of the Luminary that emits them, or of the Bodies that reflect them; by means whereof it happens, that thoſe Rays in that Part of their Vibration, which conſpire with the Motion of the Parts of the Body, enter the Body, are refracted and tranſmitted; but thoſe in a contrary Part of their Vibration reflected.

They add, that every Ray of *Light* in it's Paſſage through any refracting Surface, is put into a certain tranſient Conſtitution or State, which in the Progreſs of the Ray returns at equal Intervals, and diſpoſes the Ray at each Return to be eaſily tranſmitted through the next refracting Surface, and between each Return to be eaſily reflected by it.

Theſe alternate Diſpoſitions, which Sir *Iſaac Newton* calls Fits of *eaſy Reflection*, and of *eaſy Tranſmiſſion*, he accounts for, by ſuppoſing that the Rays of *Light*, in

impinging on Bodies, excite Vibrations therein, which happening to move faſter than the Rays, when a Ray is in that Part of the Vibration which conſpires with its Motion, it paſſes through; but when in the contrary Part of the Vibration, is beat back again: Whence every Ray is ſucceſſively diſpoſed to be eaſily reflected, or eaſily tranſmitted by every Vibration which overtakes it.

Further, a Ray of *Light* paſſing out of a Medium into another of different Denſity, and in its Paſſage making one oblique Angle with the Surface that ſeparates the Medium, will be refracted or turned out of its Right-Line, by reaſon the Rays are more ſtrongly attracted by a denſer, than a rarer Medium.

The *Refraction* of *Light*, Sir *Iſaac Newton* ſhews, is not performed by the Rays falling on the very Surface of Bodies; but without any Contact, by the Action of ſome Power in Bodies equally diffuſed throughout their Surfaces; by which ſome Power acting in other Circumſtances, they are alſo emitted and reflected.

The ſame Arguments whereby Sir *Iſaac* proves, that *Reflection* is performed without immediate Contact, he imagines, go a great Way towards demonſtrating the ſame of *Refraction*; to which he adds the following ones.

1. Be cauſe, if when *Light* falls out of Glaſs into Air, with the utmoſt Obliquity it will be tranſmitted at, it be then made to fall a little more obliquely, it becomes wholly reflected. For the Power of the Glaſs after it has reflected *Light* emerging as obliquely as poſſible, ſuppoſing the Rays to fall ſtill more obliquely, will be too ſtrong to let any of the Rays paſs; conſequently inſtead of being refracted they will be all reflected.

2. Be cauſe in thin Lamellæ, or Plates of Glaſs, *Light* is reflected and refracted ſeveral Times alternately, as the Thickneſs of the Lamellæ increaſes in arithmetical Progreſſion. For where it depends on the Thickneſs of the Lamina, which of the two it ſhall do, whether reflect it, or let it be tranſmitted.

3. Be cauſe, whereas the Power of other Bodies, both to reflect and refract *Light*, are very nearly proportional to their Denſities; yet unctuous and ſulphurous Bodies are found to reflect more ſtrongly than according to their Denſities. For as the Rays act more ſtrongly on thoſe Bodies to kindle them than on others; ſo do they again by their mutual Attraction, act more ſtrongly on the Rays to refract them.

Laſtly, be cauſe not only thoſe Rays tranſmitted thro' Glaſs, are found to be *refracted*, but alſo thoſe paſſing in the Air, or in a Vacuum near its Extremities, or even near the Extremes of many opaque Bodies, *e. gr.* the Edge of a Knife, undergo a ſimilar Inflexion, from the Attraction of the Body.

In Iceland Cryſtal is obſerved a Kind of double *Refraction*, very different from what we find in any other Body; the Rays that fall obliquely being not only diſperſed, with a double *Refraction* in one and the ſame Surface, but even the perpendicular Rays themſelves are moſt of them divided into two Beams, and are equal in Degrees of *Light*, at leaſt nearly to each other: Whence Sir *Iſaac Newton* takes Occaſion to ſuſpect that there are in *Light* ſome other original Properties beſides thoſe hitherto deſcribed; and particularly, that the Rays have different Sides, endowed with ſeveral original Properties.

For, of theſe *Refractions* the one is performed in the uſual Manner, *i. e.* the Sine of Incidence is to that of *Refraction* as 5 is to 3, and the other in an unuſual Manner; and yet the ſame Ray is refracted ſometimes in one Manner and ſometimes in another, according to the various Poſitions which its ſeveral Sides have, in reſpect of the Cryſtal. Theſe Diſpoſitions, he ſhews, muſt have exiſted originally in the Rays, without having undergone any Alterations in that Reſpect, by the Cryſtal.

Every Ray of *Light* therefore has two oppoſite Sides, the one originally endued with a Property, whereon its unuſual *Refraction* depends, and the other not endued with that Property.

Sir *Iſaac Newton* having obſerved the vivid coloured Image, projected on the Wall of a darkned Room, by the Sun-Beams tranſmitted through a Priſm, to be five

Times as long as broad, setting himself to enquire into the Reason of this Disproportion, was led from the other Experiments to the *experimentum crucis*; whence, he pretended, he discovered the Cause of the Phænomon to be, that some of the Rays of *Light* were more refracted than others, and therefore exhibited several Images of the Sun under the Appearance of one extended Lengthwise.

Thence he proceeded to conclude, that *Light* itself is a heterogeneous Mixture of Rays differently refrangible; and hence he distinguishes *Light* into two Kinds, viz. that whose Rays are equally refrangible, which he calls *homogeneous*, *similar*, or *uniform Light*; and that whose Rays are unequally refrangible; which he calls *heterogeneous Light*.

There are but three Affections of *Light*, wherein he observed its Rays to differ, viz. *Refrangibility*, *Reflexibility*, and *Colour*; and those Rays which agree in *Refrangibility*, agree also in the other two: Whence they may be well defined homogeneous, though in some other Respects they may possibly be heterogeneous.

Again, the Colours exhibited by homogeneous *Light*, he calls homogeneous Colours; and those produced by heterogeneous *Light*, heterogeneous Colours. These Definitions laid down, he advances several Propositions.

As, first, that the Sun's *Light* consists of Rays differing by indefinite Degrees of *Refrangibility*. Secondly, that Rays which differ in *Refrangibility*, when parted from one another, do proportionably differ in the Colours which they exhibit. Thirdly, that there are as many simple and homogeneous Colours as Degrees of *Refrangibility*; for to every Degree of *Refrangibility* belongs a different Colour. Fourthly, Whiteness in all Respects like that of the Sun's immediate *Light*, and of the usual Objects of our Senses, cannot be compounded of simple Colours, without an indefinite Variety of them; for to such a Composition there are required Rays endued with all the indefinite Degrees of *Refrangibility*, which infer as many simple Colours. Fifthly, the Rays of *Light* do not act on one another, in passing through the same Medium. Sixthly, the Rays of *Light* do not suffer one Alteration of their Qualities from *Refraction*, nor from the adjacent quiescent Medium. Seventhly, there can be no homogeneous Colours produced out of *Light* by *Refraction*, which are not commixed in it before; since *Refraction*, as was before observed, changes not the Qualities of the Rays, but only separates those which have divers Qualities, by means of their different *Refrangibility*. Eighthly, the Sun's *Light* is an Aggregate of homogeneous Colours; whence homogeneous Colours may be called *primitive* or *original*.

We have already observed, that the Rays of *Light* are composed of dissimilar or heterogeneous Parts; some of them being, in all Probability greater, others less. Now the smaller the Parts are, by so much the more refrangible they are, *i. e.* they are so much the more easily diverted out of their rectilinear Course; and those Parts which differ in *Refrangibility* (consequently in Bulk) we have also observed differ in Colour.

Hence arises the whole Theory of Colours; those Parts, *v. gr.* which are the most refrangible, constitute Violet Colours (say some modern Philosophers) that is, the most minute Particles of *Light*, when separately impelled on the Organ, do there excite the shortest Vibrations in the Retina, which are thence communicated by the solid Part of the optick Nerve in the Brain, and excite in us the Sensation of Violet-Colour, the dimmest and most languid of all Colours; and those Particles on the contrary, which are the least refrangible, constitute a Ray of a red Colour, *i. e.* the greatest Particles of *Light* excite the longest Vibrations in the Retina, and so convey the Sensation of a red Colour, as being the most bright and vivid of all others. The other Particles being distinguished into little Rays, according to their respective Magnitudes and Degrees of *Refrangibility*, excite intermediate Vibrations, and so occasion Sensations of the intermediate Colours; in like Manner as the Vibrations of the Air, according to their different Magnitudes, excite Sensations of different Sounds. The Colours then of these little Rays not being any adventitious Modifications of them, but connate, primitive, and necessary Pro-

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perties, resulting in all Probability from their different Magnitudes, must be perpetual and immutable, not to be altered by any Reflection, Refraction, or any subsequent Modification.

Others explain Refraction in a clearer and more concise Manner, and say that it happens either by *acceding to the Perpendicular*, or *receding from it*. For when *Light* passes from a rarer or thinner Medium into one more dense, *viz.* from Air into Water or Glass, then it is refracted by acceding to the Perpendicular; but when it passes from a thicker Medium into a thinner, *viz.* from Glass into Water, or from Water into Air, the *Refraction* happens by its Recess from the Perpendicular.

But to give a still clearer Notion of the *Refraction* of *Light*, they illustrate it with the following Experiments:—Therefore let us imagine that A H B G C, fig. 8. is an earthen Vessel, in the Bottom whereof there is the Crown-piece B, that Crown-piece will certainly be seen by the Eye placed in E, by means of the Ray B E; but not by the Eye placed in D; for the Ray D H is terminated in H, not in B. But if the Vessel be filled with Water to the very Top or Superficies, A C (which though it be seen here covered with a Cloth, can notwithstanding, be imagined uncovered) then the Ray which was carried from the Point B into E, will be refracted in the Point I, where the Superficies of the Air occurs, and tends towards D, in receding from the Line F i G, which is perpendicular to the Superficies A i C: And then the Crown-piece will be seen by him who will be placed in D; and will be referred not to the Point B, but to the Point H.

The Experiment of this is easily made, by taking a pretty deep Dish, and putting in the Bottom a Crown or Half a Crown-piece, and then going backward from the Dish till the Edges thereof hinder us from seeing the Piece any longer; but if we put Water in the Dish, we shall see the Piece from that Place; whence we could not see it before.

If the Vessel A H B G C, fig. 8. be a Glass Vessel, and the Side C G opposed to the Sun, as well as the Superficy A i C, be covered in such a Manner, that there be but the very little Hole i left for the Passage of the *Light*, then the Ray D i will tend towards the Point H. But if the Vessel be filled with Water, through the small Tube M N, then the Ray which was carried into H will be *refracted* by acceding to the perpendicular F i G, and environ the Point B. The Quantity of this *Refraction* will be known, by adapting either a Semicircle or the Quadrant of a Circle within the Vessel, or in any other Manner; for I do not pretend to relate here the different Means invented, used, and adapted by the Learned, to the Mensuration of *Refraction*.

But to understand better what follows; we must admit here the Definitions of divers Angles: Therefore let's examine the 19th Figure of our Table of *Opticks*, in which the Ray A B is imagined to pass obliquely from Air into Water or Glass; this being directed towards P, will notwithstanding descend refracted into the Point I, because meeting with a denser Body, by acceding to the Perpendicular H B G, and for the same Reason the Ray K B, which inclined towards O, will incline towards L.

Then the Angle A B C formed by the Ray A B, and the Superficy B C, is called *Angle of Incidence*; likewise the Angle K B C, is an *Angle of Incidence*.

The Angle A B H, formed by the Ray A B, and the Perpendicular H B, is the *Angle of Inclination*, and the same is to be said of the Angle K B M.

The Angle G B I, formed by the refracted Ray B I, and the Perpendicular B G, is called a *refracted Angle*, as well as the Angle N B L.

Lastly, the Angle I B P, formed by the refracted Ray B I, and the right Ray A B, imagined to be carried into P (the same to be said of the Angle L B O) is called the *Angle of Refraction*.

Des Cartes has very ingeniously observed, that there is not always the same Ratio between the *Angles of Inclination*, and those *refracted*. For that Ratio changes according to the various Inclination of the Rays; whence though the Ratio which is between the Angle of Inclination A B H, and the refracted Angle G B I, be very well understood, it cannot be carried to K B M and N B L,

N B L, because the Angle A B is more inclined on the Superficy C B than K B. But the Ratio of the Sines of the Angles of Inclination to the Sines of the *refracted* Angles, is always the same, *v. gr.* if we know the Ratio of the Line A H, which is the Sine of the Angle A B H to the Line G I, which is the Sine of the refracted Angle G B I; we'll find the same Ratio between the Angle K M, the Sine of the Angle K B M, and the Line N L, the Sine of the Angle N B L.

This having not been attentively considered by *Alhazen*, an *Arab*, who lived in the 11th Century; nor by *Vitellius* who lived in the 14th, both attempted to observe by means of Instruments the Quantity of the refracted Angles, to reduce them into Tables; but as there is always the same Ratio between the Sines of the Angles of Inclination, and the Sines of the refracted Angles; therefore all other *Refractions* must be reduced by Calculation, from the sole known *Refraction of Light*, from Air into Water, or into Glass, or *vicissim*.

Des Cartes has observed, that the Ratio of the Sines of the Angles of Inclination to the Sines of refracted Angles, when the Rays of Light pass from the Air into Water, is almost as 4 to 3; or if we want a more accurate Measure, as 250 to 187.

Therefore if the Line A H, which is the Sine of the Angle of Inclination A B H, be divided into four Parts; we'll find in the Line G I, or in the Sine of the refracted Angle G B I, three Parts equal to those four. Likewise the Line K M, will be to the Line N L, as 4 to 3; and the same Ratio will be between all Sines of the Angles of Inclination, and the Sines of refracted Angles.

If the Refraction should happen from Water into Air; the Ratio of the Sines should be inverted, *viz.* as 3 to 4, or as 187 to 250.

But if the Ray A B was to fall in Glass, not in Water, its Refraction would be greater; or it would approach nearer the Perpendicular; and then the Ratio of the Sine A H, to the Sine G I, would be as 3 to 2. The same must be understood of all the Sines of an Angle whatever.—More of this in the *Dioptricks*.

As to COLOUR, some define it a Property inherent in Light, whereby, according to the different Sizes, or Magnitudes of its Parts, it excites different Vibrations in the Fibres of the *Optick* Nerve; which propagated to the *Sensorium*, affect the Mind with different Sensations.

Or, *Colour* may be defined a Sensation of the Soul, excited by the Application of Light to the Retina of the Eye; and different as that Light differs in the Degree of its Refrangibility, and the Magnitude of its component Parts.

In the former View, therefore, Light is the Subject of *Colour*; in the latter it is the Agent.

Various are the Opinions of antient and modern Authors, of the several Sects of Philosophers, with Regard to the Nature and Origin of the Phenomenon *Colour*: The most popular Opinion is that of the *Aristotelians*; who maintain *Colour* to be a Quality residing in the colour'd Body; and to exist independently of Light: Tho' *Aristotle* says, at the same Time, that *Colour* cannot be seen without Light: For Light is the Act of that which is clear, *viz.* of the Air. For *Colour*, approached near the Eye, cannot be seen but by Means of the interjected Air. Whereby *Aristotle* seems to insinuate, that Light is entirely different from *Colour*.

The *Cartesians* come nearer the Matter; they own that as the colour'd Body is not immediately applied to the Organ, to occasion the Sensation; and that as no Body can affect the Sense but by immediate Contact; the coloured Body does not excite the Sensation of itself, or contribute any Thing to it; otherwise than by moving some interposed Medium, and by that the Organ of Sight.

They add, that as we find that Bodies do not affect the Sense in the Dark, Light only occasions the Sense of *Colour*, by moving the Organ; and that colour'd Bodies are no further concerned, than as they reflect the Light with a certain Modification: The Differences in their *Colours* arising from a Difference in the Texture of their Parts, whereby they are disposed to reflect the Light, with this or that Modification.

But Sir *Isaac Newton* thinks, that he has established a solid and consistent Theory of *Colours*; built on sure

Experiments, and solving all the Phenomena thereof: His Doctrine is as follows:

That Author says, that it is found by Experience, that Rays, or Beams of Light, are composed of Particles very heterogeneous, or dissimilar to each other, *i. e.* some of them, as it is highly probable, are larger, and others less. For a Ray of Light being received on a refracting Surface, in a dark Place, is not wholly refracted to a single Point; but split, as it were, and diffused into several Radioli, or little Rays, *i. e.* those Particles of the Light which are the most minute, are of all others the most easily and most considerably diverted, by the Action of the refracting Surface, out of their rectilinear Course: And the rest, as each exceeds another in Magnitude, so is it with more Difficulty, and less considerably turned of its right Line to the intermediate Points.

Now each Ray of Light, as it differs from another in its Degree of Refrangibility, so does it differ from it in *Colour*; this is warranted by numerous Experiments. Those Particles, *v. gr.* which are more refracted, are found to constitute a Ray of a Violet *Colour*, *i. e.* in all Probability, the most minute Particles of Light, thus separately impelled, excite the shortest Vibration in the Retina; which are thence propagated by the solid Fibres of the *Optick* Nerves into the Brain, there to excite the Sensation of Violet *Colour*; as being the most dusky and languid of all *Colours*.

Again, those Particles which are the least refracted, constitute a *Radiolus*, or Ray of a red *Colour*, *i. e.* the largest Particles of Light excite the longest Vibrations in the Retina; so as to excite the Sensation of red *Colour*, the brightest and most vivid of all others.

The other Particles being in like Manner separated, according to their respective Magnitudes, into little Rays, excite the intermediate Vibrations, and thus occasion the Sensation of the intermediate *Colours*; much in the same Manner as the several Vibrations of the Air, according to their respective Magnitudes, excite the Sensations of different Sounds.

To this it may be added, that not only the more distinct and notable Colours of red, yellow, blue, &c. have thus their Rise from the different Magnitude and Refrangibility of the Rays; but also the intermediate Degrees or Shades of the same Colour, as of yellow up to green, of red down to yellow, &c.

Further, the *Colours* of these little Rays, not being any adventitious Modifications thereof, but connate, primitive, and necessary Properties; as consisting, in all Probability, in the Magnitude of their Parts, must be perpetual and immutable, *i. e.* cannot be changed by any future Refraction or Reflection, or any Modification whatsoever.

This, the *Newtonians* pretend, is confirm'd by Abundance of Experiments; all Endeavours having been used, after separating a colour'd Ray from those of other Kinds, to change it into some other *Colour*, by repeated Refractions, but to no Effect. Apparent Transmutations of *Colours*, indeed, may be effected, *viz.* where there is an Assemblage, or Mixture of Rays of different Kinds; the component *Colours* never appearing in their natural Hue in such Mixtures, but always allayed, and tempered with each other: Whence results a middling Kind of *Colour*, which, by Refraction, may be separated into the component ones: And those after Separation, being reunited, return to their former *Colour*.

Hence the Transmutations of *Colours*, by mixing those of different Kinds, are not real, but mere Appearances or Deceptions of the Sight: For the Rays being again severed, exhibit the same *Colours* as at first. Thus blue and yellow Powders, well mixed, appear to the naked Eye green; yet, without having passed any Alteration, when viewed through a Microscope, the blue and yellow Particles still appear distinct.

Hence there arise two Kinds of *Colours*, the one original and simple, produced by homogeneous Light; or by Rays that have the same Degree of Refrangibility, and the same Magnitude of their Parts; such as red, yellow, blue, green, violet, purple, orange, and Indigo; with all their intermediate Tints and Gradations.

The other Kind of *Colour* is secondary or heterogeneous, compounded of the primary ones, or of a Mixture of Rays differently refrangible, &c.

There

There may also be secondary *Colours*, produced by Composition, like the primary ones, or those consisting of homogeneous Light, as to the Species of Appearance of the *Colour*; but not as to the Permanency, or Immutability thereof. Thus yellow and blue make green, red and yellow, orange, orange and yellowish green, yellow: And in the general, if any two *Colours* be mixed, which in the Series of those generated by the Prism, are not too far apart, from their Mixture results that *Colour*, which in the said Series is found in the Midway between them: But those situated at too great a Distance do not so.

Indeed the more any *Colour* is compounded, the less perfect and vivid it is; by too much Composition they may be dilated and weaken'd till they cease. By Composition there may likewise be produced *Colours*, not like any of those of homogeneous Light.

The most extraordinary Composition is that of Whiteness; for to this all the primary *Colours* above-mentioned are required; and those to be mixed in a certain Degree. Hence it is that white is the ordinary *Colour* of Light; Light being nothing else but a confused Assemblage of Rays of all *Colours*.

If the Rays of different *Colours* do thus begin to be separated by one Refraction of one single Surface, the Separation is much promoted, so as even to become sensible to the Eye by a double Refraction. This is observed in the two Surfaces of any Glass, provided those Surfaces be not parallel: But of all others it is most sensible in the two Faces of a triangular Prism, the Phenomena whereof, as they are the Touchstone of all Theories of *Colours*; and as they contain the Foundation of that here delivered, we shall lay down as follows.

1. The Rays of the Sun transmitted through a triangular Prism, exhibit an Image of various *Colours* (the Chief whereof are Red, Yellow, Green, Blue, and Violet) on the opposite Wall.

The Reason is, that the different coloured Rays are separated by Refraction.

2. This Image is not round but oblong; its Length, when the Prism is an Angle of 60 or 65 Degrees, being five Times its Breadth. The Reason is, that some of the Rays are refracted more than others; and by that Means exhibit several Images of the Sun, extended Lengthwise instead of one.

3. Those Rays which exhibit yellow, are turned further from the rectilinear Course, than those which exhibit red; those which exhibit green than those which exhibit yellow: But of all others, those which exhibit Violet the most: Accordingly, if the Prism through which the Light is transmitted be turned about its Axis, so as the red, yellow, green, &c. Rays be projected, in order, through a narrow Aperture into another Prism placed at the Distance of about 12 Feet; the yellow, green, &c. Rays, though falling through the same Aperture, in the same Manner, and on the same Point of the second Prism, will not be refracted to the same Place as the Red, but to a Point at some Distance from it; on that Side to which the Rotation is made.

This is what Sir Isaac Newton calls the *experimentum crucis*; being that which led him out of the Difficulties, into which the first Phenomenon, &c. had thrown him, and plainly shewed a different Degree of Refrangibility, and a different *Colour* corresponding thereto in the Rays of Light; and that yellow Rays, *v. gr.* are more refracted than red ones; green ones more than yellow ones; and blue and violet ones most of all.

4. The *Colours* of coloured Rays, well separated by the Prism, are not at all changed or destroyed by passing an illuminated Medium, nor by their mutual Decussation, their bordering on a deep Shadow, nor their being reflected from any natural Body, or refracted through any one, in a Place howsoever obscure.

The Reason is, that *Colours* are not Modifications arising from Refraction, or Reflection, but immutable Properties, and such as belong to the Nature of the Rays.

5. An Assemblage of all the Kinds of coloured Rays, collected either by several Prisms, by a Convex Lens, or a Concave Mirror, or in any other Manner, form what we call *Whiteness*, yet each of these, after Decussation, becoming separated, again exhibits its proper *Co-*

lour; for as the Ray was white before its Parts were separated by Refraction; so the Parts being remixed it becomes white again; and coloured Rays, when they meet together, do not destroy one another, but are only interspersed.

Hence a red, green, yellow, blue, and violet *Colour*, being mixed in a certain Proportion, appear whitish, *i. e.* are of such a *Colour* as rises from white and black mixed together: And were there not some Rays absorbed and lost, would be plainly white. In like Manner, if a Paper cut into a Circle, be stained with each of those *Colours* separately, and in a certain Proportion, the several *Colours* will disappear, add the whole Paper appear of one continued *Colour*; which will be a Mean between white and black.

6. If the Rays of the Sun fall very obliquely on the inner Surface of a Prism, those that are reflected will be Violet, those transmitted Red.

For the Rays were coloured before any Separation; and by how much they are the more refrangible, by so much they are the more easily reflected, and by that Means are separated.

7. If two hollow Prisms, the one filled with blue Fluid, the other with a red one, be joined together, they will be opaque, though each a-part be transparent. For the one transmitting none but blue Rays, and the other none but red ones, the two together will transmit none at all.

8. All natural Bodies, especially white ones, viewed through a Prism held to the Eye, appear fimbriated, or bordered, on one Side with Red and Yellow, and on the other with Blue and Violet; for those Fimbriæ are the Extremes of entire Images, which the Rays of any Kind, as they are more or less refracted, would exhibit nearer, or at a greater Distance from the real Place of the Object.

9. If two Prisms be so placed, as that the Red of the one, and the Purple of the other meet together, in a Paper fit for the Purpose, encompassed with Darkness, the Image will appear pale; and if viewed through a third Prism, held to the Eye at a proper Distance, it will appear double; the one Red and the other Purple.

In like Manner if two Powders, the one perfectly red, the other blue, be mixed; any little Body covered pretty deeply with this Mixture, and viewed through a Prism held to the Eye, will exhibit a double Image, the one Red and the other Blue: In regard, the Red and Purple of blue Rays are separated by their unequal Refraction.

10. If the Rays transmitted through a Convex Lens be received on a Paper, ere they meet in a Focus, the Confines or Boundaries of Light and Shadow, will appear tinged with a red *Colour*; but if they be received beyond the Focus, with a blue one.

Because, in the first Case, the red Rays being somewhat more refracted, are the higher; but in the second, after Decussation in the Focus, the blue ones.

11. If the Rays about to pass through either Side of the Papillæ, be intercepted by the Interposition of any opaque Body near the Eye, the Extremes of Bodies, placed as if viewed through a Prism, will appear tinged with *Colours*, though those not very vivid.

For then the Rays transmitted through the rest of the Pupil, will be separated by Refraction into *Colours*, without being diluted by the Admixture of the intercepted Rays, which would be refracted in a different Manner. And hence it is, that a Body viewed through a Paper pierced with two Holes, appears double, and also tinged with *Colours*.

As to *Colours* of thin Lamine, or Plates. — As Rays of different *Colours* are separated by the Refraction of Prisms and other thick Bodies, so are they separated, though in a different Manner, in the thin Lamellæ or Plates of any pellucid Matter, *v. gr.* the Bubbles raised in Water, thickened by Soap, &c. for all Lamellæ, under a determinate Thickness, transmit Rays of all *Colours*, without reflecting any at all: But as they increase in Thickness, in arithmetical Proportion, they begin to reflect, first blue Rays, then in Order, green, yellow and red, all pure: Then again, blue, green, yellow, red, more and more mixed and diluted, till at length arriving at a certain Thickness, they reflect Rays of all *Colours*.

Colours perfectly intermixed, *viz.* white.

But in whatsoever Part a slender Lamella reflects any Colour, *v. gr.* blue; in that Part it always transmits the opposite Colour, *v. gr.* red or yellow.

It is found by Experiment, that the Difference of Colours of a Plate, does not depend on the Medium that encompasses it; but the Degree of Vividness does: *Ceteris paribus*, the Colour will be more vivid, if the denser Medium be encompassed with the rarer. A Plate, *Ceteris paribus*, reflects more Light as it is thinner; as far as a certain Degree of Thinness, beyond which it reflects no Light at all.

In Plates, whose Thickness increase in the arithmetical Proportion of the natural Numbers 1, 2, 3, 4, 5, &c. if the first or thinnest reflect any homogeneous Ray, the second will transmit it; the third again will reflect it: And thus is the same Ray alternately reflected and transmitted, *i. e.* the Plates corresponding to the odd Numbers, 1, 3, 5, 7, &c. will reflect the same Rays that those corresponding to the even ones, 2, 4, 6, 8, &c. transmit.

Hence an homogeneous Colour in a Plate, is said to be of the *first Order*, if the Plate reflects all the Rays of that Colour. In a Plate, whose Thinness is triple the first, it is said to be of the *second Order*: In another, whose Thinness is five times that of the first, it is said to be of the *third Order*, &c.

A Colour of the *first Order* is the most vivid of any; and successively the Vividness of the Colour increases, as the Quantity of the Order increases: The more the Thickness of the Plate is increased, the more Colours it reflects; and those of more different Orders. In some Plates, the Colour will vary as the Position of the Eye varies; in others it is permanent.

With respect to Colours of natural Bodies, they only appear of different Colours, as their Surfaces are disposed to reflect Rays of this or that Colour alone; or of this or that Colour more abundantly than any other: Hence Bodies appear of that Colour which arises from the Mixture of the reflected Rays.

All natural Bodies consist of very thin, transparent Lamellæ, which, if they be so disposed, with regard to each other, as that there happens no Reflections or Refractions, in their Interstices, those Bodies, become pellucid, or transparent: But if their Intervals be so large, and those filled with such Matter; or so empty (with regard to the Density of the Parts themselves) as that there happens a Number of Reflections and Refractions within the Body; the Body, in that Case, becomes opaque.

The Rays which are not reflected from an opaque Body, penetrate into it; and there suffering innumerable Reflections and Refractions, at length unite themselves to the Particles of the Body itself.

Hence an opaque Body grows dark the sooner, as it reflects Light less copiously: Whence we see why a white Body, which reflects almost all the Rays that strike upon it, heats much more slowly than a black one, which reflects scarce any.

To determine that Constitution of the Surface of Bodies, whereon their Colour depends, it must be observed, that the smallest Corpuscles, or first Particles whereof Surfaces are made up, are most thin and transparent, and separated by a Medium of a different Density, from the Particles themselves. In the Surface then of every coloured Body, are innumerable smaller, thin Plates, corresponding to those of Bubbles: Wherefore what has been observed of those, may be understood of these.

Hence we gather, that the Colour of a Body depends on the Density and Thickness of the Parts of the Body, between the Pores of the Surface: That the Colour is more vivid and homogeneous, as the Parts are thinner; that, *Ceteris paribus*, the said Parts are the thickest when the Body is red; and the thinnest when violet: That the Parts of Bodies are usually much denser than the Medium contain'd in their Interstices; but that in the Tails of Peacocks, in some Silks, and generally, in all Bodies whose Colours vary according to the Situation of the Eye, it is less: And that the Colour of a Body is less vivid to the Eye, as it has a denser Medium within its Pores.

Now of the several opaque Bodies, those consisting of the thinnest Lamellæ, are black; those consisting either

of the thickest Lamellæ, most of which are of some intermediate Thickness, are blue, green, yellow, or red; inasmuch as they reflect the Rays of that particular Colour, much more copiously than that of any other Colour, most of which last, either absorb and extinguish, by intercepting them, or else transmit.

Hence it is, that some Liquors, *v. gr.* an Infusion of *Lignum Nephreticum*, appears red, or yellow, if viewed by reflected Light; and blue by transmitted Light: And Gold Leaves yellow in the former Circumstances, but green or blue in the latter.

To this may be added, that some of the Powders used by Painters, have their Colour changed by being finely ground; which must be occasioned by the Comminution or breaking of their small Parts into others still smaller, just as a Lamella has its Colour altered, by altering its Thickness.

In fine, those odd Phænomena arising from the Mixture of Liquors of different Colours, can no Way be better accounted for, than from the various Actions of the saline, &c. Corpuscles of one Liquor, with the colour'd Corpuscles of another: If they unite, the Mass will either swell or shrink, and thereby its Density will be altered; if they ferment, the Size of the Particles may be diminished, and thereby colour'd Liquors may become transparent: If they coagulate, an opaque Liquor may be produced of two transparent ones.

Hence it is easy to see why a coloured Liquid, in a Glass of a conical Figure, placed between the Eye and the Light, appears of a different Colour in different Parts of the Vessel; there being more and more Rays intercepted; as they pass through a longer or a shorter Section of the Vessel: Till, at the Base, they are all intercepted; and none seen but those reflected.

From the various Colours of natural Bodies, Sir Isaac Newton observes, the Bigness of their component Parts may be estimated: For that the Parts of Bodies do properly exhibit the same Colour with a Lamella of equal Thickness, provided the Density in both be the same.

Note, That Ray has been heretofore so often mention'd, that it is proper I should inform the Reader what Ray is: Therefore,

RAY, is a Beam, or Line of Light, propagated from a radiant Point, through an unresisting Medium.

Sir Isaac Newton defines Rays to be the least Parts of Light, whether successive in the same Line, or contemporary in several Lines.

For that Light consists of Parts of both Kinds, appears hence, that one may stop what comes this Moment in any Point, and let pass that which comes the next. Now the least Light, or Part of Light, which may be thus stopped alone, he calls a *Ray of Light*.

If the Parts of a Ray of Light do all lie strait between the Radiant and the Eye, the Ray is said to be *direct*. If any of them be turned out of that Direction, or bent in their Passage, the Ray is said to be *refracted*. If it strikes on the Surface of any Body, and be driven back, it is said to be *reflected*.

In each Case, the Ray, as it falls either directly on the Eye, or on the Point of Reflection, or of Refraction, is said to be *incident*.

Again, if several Rays be propagated from the Radiant equi-distantly from one another, they are called *parallel Rays*. If they come inclining towards each other, they are called *converging Rays*. And if they go continually receding from each other, they are called *diverging Rays*.

It is from the Circumstances of Rays, that the several Kinds of Bodies are distinguished in Opticks. A Body, *e. gr.* that diffuses its own Light, or emits Rays of its own, is called a *lucid* or *luminous Body*. If it only reflects Rays which it receives from another, it is called an *illuminated Body*. If it only transmits Rays, it is called a *transparent Body*. If it intercepts the Rays, or refuses them Passage, it is called an *opaque Body*.

Hence no Body radiates, *i. e.* emits Rays, unless it be either luminous or illumined.

It is by Means of Rays reflected, from the several Points of illumined Objects to the Eye, that they become visible, and that Vision is performed, whence such Rays are called *visual*.

In effect we find that any Point of an Object is seen in all Places to which a Right-Line may be drawn from that Point: But it is allowed nothing can be seen without Light, therefore every Point of an Object diffuses innumerable Rays every Way. Again, from other Experiments it appears, that the Images of all Objects, whence Right-Lines may be drawn to the Eye, are pointed in the Eye behind the Crystalline, very small, but very distinct.

And lastly, from other Experiments, that each Ray carries with it the Species, or Image of the radiating Point; and that the several Rays emitted from the same Point are again united in one Point, by the Crystalline, and thus thrown on the Retina.

It is the Spissitude or Closeness of the Rays emitted from a luminous Body, that constitutes the Intensity of the Light. Yet the Direction wherein the Rays strike the Eye has a good Sway. In effect a perpendicular Ray striking with more Force than an oblique one, in the Ratio of the whole Sine of the Angle of Obliquity (as follows from the Laws of Percussion) a perpendicular Ray will affect the Eye more vividly than an oblique one in that Ratio.

If then the Spissitude of the Rays be equal, the Intensity will be as the Direction; if the Direction be the same, the Intensity will be as the Spissitude. If both differ, the Intensity will be in a Ratio compounded of the Direction, and the Spissitude.

Hence, *first*, if Light be propagated in *parallel Rays*, through an unresisting Medium, its Intensity will not be varied by Distance.

Secondly, if Light be propagated in *diverging Rays*, through an unresisting Medium, its Intensity will decrease in a duplicate Ratio of the Distances from the radiant Point reciprocally.

Thirdly, if Light be propagated in *converging Rays*, through an unresisting Medium; its Intensity will increase in a duplicate Ratio of the Distances from the Point of Concourse, reciprocally.

Fourthly, if the Breadth of an illuminated Plane be to the Distance of the radiant Point, as 1 to 2000000, it is the same Thing as if the Rays struck upon its Parallel: And hence, since the Diameter of the Pupil of the Eye, when largest, scarce exceeds $\frac{1}{4}$ of an Inch; the Rays will fall upon it parallel, as to Sense, at the Distance of 3860 *English* Feet, which is nearly six Furlongs.

The Effect of concave Lenses and convex Mirrors is to make parallel Rays diverged; *converging Rays* become parallel, and *diverging Rays* to become more divergent.

The Effect of *convex Lenses*, and concave Mirrors, is to make *diverging Rays* become parallel; *parallel Rays* become convergent, and *converging Rays* to converge the more.

The Rays of Light are not homogeneous or similar, but differ in all the Properties we know of, *viz.* Refrangibility, Reflexibility, and Colour.

It is probably from the different Refrangibility, that the other Differences have their Rise, at least it appears, that those Rays which agree or differ in this, do so in all the rest.

That from the different Sensations the differently disposed Rays excite in us, we call them *red Rays*, *yellow Rays*, &c.

The Effect of the Prism is to separate and sort the different Kinds of Rays, which come blended promiscuously from the Sun; and to throw each Kind by itself, according to its Degree of Refrangibility and Colour, Red to Red, Blue to Blue, &c.

Besides, Refrangibility and the other Properties of the Rays of Light already ascertained by Observation and Experiment, Sir Isaac Newton suspects they may have many more, particularly a Power of being inflected, or bent by the Action of distant Bodies; and those Rays which differ in Refrangibility, he conceives likewise to differ in this Flexibility.

In passing by the Edges and Sides of Bodies, he conceives that the Rays may be bent several Times backwards and forwards, with a Motion like that of an Eel; and that those Rays which appear to fall on Bodies, are reflected or refracted before they arrive at the Bodies. And add, that they may be refracted, reflected, and

inflected, all by the same Principle acting in different Circumstances.

Again, do not the Rays which fall on the Bottom of the Eye, excite Vibrations in Retina; which being propagated along the Fibres of the optick Nerve into the Brain cause Vision? And do not several Sorts of Rays make Vibrations of several Bignesses, which excite Sensations of several Colours, much after the Manner as the Vibrations of the Air, according to their several Bignesses, excite Sensations of several Sounds? Particularly, do not the most refrangible Rays excite the shortest Vibrations, to make a Sensation of a deep Violet; and the least refrangible, the largest, to make a Sensation of a deep Red? And the several intermediate Kinds of Rays, Vibrations of intermediate Bignesses, to make Sensations of intermediate Colours?

And may not the Harmony and Discord of Colours arise from the Proportion of these Vibrations, as those of Sound depend on the Vibrations of the Air? For some Colours, if viewed together, are agreeable, as Gold and Indico; others disagreeable, as Blue and Green, &c.

Again, have not the Rays of Light several Sides endued with several original Properties?—It is certain we find that every Ray of Light has two opposite Sides, originally endued with a Property whereon the unusual Refraction of Island Crystal depends, and others two opposite Sides not endued with that Property.

Lastly, are not the Rays of Light very small Bodies emitted from shining Substances?

Such Bodies may have all the Conditions of Light; and there is that Action and Re-action between transparent Bodies and Light, which very much resemble the attractive Force between other Bodies. Nothing more is required for the Production of all the various Colours, and all the Degrees of Refrangibility, but that the Rays of Light be Bodies of different Sizes; the least of which may make Violet, the weakest and darkest of the Colours, and be the most easily diverted by refracting Surfaces from its rectilinear Course; and the rest as they are bigger and bigger, may make the stronger and more lucid Colours, Blue, Green, Yellow, and Red.

Nor is any Thing more requisite for the putting of the Rays into Fits of easy Reflection and easy Transmission, than that they be small Bodies, which by Attraction or some other Force, excite Vibrations in the Body they act upon; which Vibrations being swifter than the Rays, overtake them successively, and agitate them so as by Degrees to increase and diminish their Velocity, and thereby put them into those Fits.

Lastly, the unusual Refraction of Island Crystal, looks very much as if it were performed by some attractive Virtue lodged in certain Sides, both of the Rays and the Crystal.

In Opticks, we commonly call *common Ray* a Right-Line drawn from the Point of Concourse of the two optical Axes, through the Middle of the Right-Line which passes through the Middle of the Centers of the Pupil of the two Eyes.

Note, That an *optical Axis*, is a Ray passing through the Center of the Eye, or it is that Ray which proceeding through the Middle of the luminous Cone, falls perpendicularly on the crystalline Humour, and consequently passes through the Center of the Eye.—*Common* or *mean Axis*, is a Right-Line drawn from the Point of Concourse of the two optick Nerves, thro' the Middle of the Right-Lines, which joins the Extremity of the same optick Nerves.

Note, also, That a *Cone of Rays* includes all the several Rays which fall from any Point of a Radiant, on the Surface of a Glass.

Note, again, That a *radiant Point* is any Point of a visible Object, whence Rays proceed. Every *radiant Point* diffuses innumerable Rays all around; but only those Radiants are visible, from which Right-Lines may be drawn to the Pupil, because the Rays are all Right-Lines.—All the Lines proceeding from the same *Radiant*, continually diverge; the Crystalline collects or reunites them again.—Every Ray is supposed to carry with it the Species or Image of the *Radiant*.

Note, again, That the Medium so often mentioned in this Treatise, is that Space or Region, through which a Body passes, in its Motion towards any Point.

Note, besides, That having thus carefully examined the *Organ of Vision*; the Nature of *Light*, and *Colours*, *Reflection*, *Refraction*, *Ray*, *Medium*, &c. what remains with regard to *Vision*, is only to give a general Idea of the whole Process, in which all the several Parts are concerned: Therefore,

As to the different Opinions or Systems of *Vision*. — The *Platonists* and *Stoicks*, held it to be effected by the Emission of Rays out of the Eyes; conceiving, that there was a Sort of Light thus darted out, which, with the Light of the external Air, taking as it were hold of the Objects, rendered them visible; and thus returning back again to the Eye, altered and new modified by the Contact of the Object, made an Impression on the Pupil, which gave the Sensation of the Object.

The Reasons whereby they maintain their Opinion, are fetched, 1. From the Brightness and Lustre of the Eye: 2. From our seeing a remote Cloud, without seeing one which we are encompassed withal; (the Rays being supposed too brisk and penetrating to be stoppt by the near Cloud, but growing languid at a greater Distance, are returned to the Eye:) 3. From our not seeing an Object laid on the Pupil: 4. From the Eyes being weary with Seeing, *i. e.* by emitting great Quantities of Rays: And, lastly, From Animals which see in the Night; as Cats, Lions, Moles, Owls, and some Men.

The *Epicureans* held Vision to be performed by the Emanation of corporeal Species or Images from Objects; or a Sort of atomical Effluvia, continually flying off from the intimate Parts of Objects to the Eye.

Their chief Reasons are, 1. That the Object must necessarily be united to the visive Faculty; and since it is not united by itself, it must be so by some Species that represents it, and that is continually flying from Bodies: 2. That it frequently happens, that old Men see remote Objects better than near ones; the Distance making the Species thinner, and more commensurate to the Delicacy of their Organ.

The *Peripateticks* hold, with *Epicurus*, that Vision is performed by the Reception of Species; but differ from him in the Circumstances: For they will have the Species (which they call *intentional*) to be incorporeal.

It is true *Aristotle's* Doctrine of *Vision*, delivered in his Chapter *De Aspectu*, amounts to no more than this; that Objects must move some intermediate Body, that by this they may move the Organ of Sight. — To which he adds, in another Place, that when we perceive Bodies, it is their Species, not their Matter, that we receive; as a Seal makes an Impression on Wax, without the Wax retaining any Thing of the Seal.

But this vague and obscure Account, the *Peripateticks* have thought fit to improve. — Accordingly what their Master called *Species*, the Disciples understanding of real proper Species, and assert, that every visible Object expresses a perfect Image of itself, in the Air contiguous to it; and this Image, another somewhat less, in the next Air; and the third another, &c. till the last Image arrives at the Crystalline, which they hold for the chief Organ of Sight; or that which immediately moves the Soul. — These Images they call *intentional Species*.

The modern Philosophers, as the *Cartesians* and *Newtonians*, give a better Account of *Vision*. They all agree, that it is performed by Rays of Light reflected from the several Points of Objects, received in at the Pupil, refracted and collected in their Passage through the Coats and Humours to the Retina; and thus striking, or making an Impression on so many Points thereof: Which Impression is conveyed, by the correspondent Capillaments of the optick Nerve, to the Brain, &c.

As for the *Peripatetick* Series, or Chain of Images, it is a mere Chimera; and *Aristotle's* Meaning is better understood without, than with them. In Effect, setting this aside, the *Aristotelian*, *Cartesian*, and *Newtonian* Doctrines, of *Vision*, are very consistent: For Sir *Isaac Newton* imagines, as already observed, that *Vision* is performed chiefly by the Vibrations of a fine Medium,

which penetrates all Bodies, excited in the Bottom of the Eye by the Rays of Light; and propagated through the Capillaments of the optick Nerves to the Sensorium. And *Des Cartes* maintains; that the Sun pressing the *Materia subtilis*, wherewith the World is filled every Way, the Vibrations or Pulses of that Matter reflected from Objects, are communicated to the Eye, and thence to the Sensory: So that the Action or Vibration of a Medium, is equally supposed in all.

In order to *Vision*, we are certain, it is required that the Rays of Light be thrown from the visible Object to the Eye: What befalls them in the Eye, will be conceived from what follows.

Suppose, *e. gr.* Z the Eye, and A B C the Object, (Tab. *Optick*, fig. 11.) now though every Point of an Object be a radiant Point, that though there be Rays reflected from every Point of the Object to every Point of the circumambient Space, each carrying with it its respective Colour, (which we falsely imagine to be those of the Object) yet as only those Rays which pass thro' the Pupil of the Eye affect the Sense, we shall here consider none else.

And again, though there be a great Number of Rays passing from one radiant Point, as B, through the Pupil, yet we shall only consider the Action of a few of them; as B D, B E, B F.

Now then the Ray B D falling perpendicularly on the Surface, E D F, will pass out of the Air into the aqueous Humour, without any Refraction, and proceed right to H; where, falling perpendicularly on the Surface of the crystalline Humour, it will go on, without any Refraction, to M; where again falling perpendicularly on the Surface of the vitreous Humour, it will proceed streight to the Point O, in the Fund or Bottom of the Eye. Again, the Ray B E passing obliquely out of the Air upon the Surface of the watery Humour E D F, will be refracted, and approach towards the perpendicular E P: Thus proceeding to the Point G, in the Surface of the crystalline, it will be there refracted still nearer to the Perpendicular. — So also E G falling obliquely out of the Air into a harder Body, will be refracted towards the Perpendicular G R, and falling on the Point L of the Surface of the vitreous Humour, it will still be brought nearer to M.

Lastly, G L falling obliquely out of a denser, upon the Surface of a rarer Body, L M N, will be refracted, and recede from the Perpendicular L T; in receding from which, it is evident it approaches towards the Ray B D O, and may be so refracted as to meet the other in O. — In like Manner the Ray B F being refracted in B will turn to I, and thence to N, and thence to the others in O. But the Rays between B E and B F, being somewhat less refracted, will not meet precisely in the same Point O.

Thus will the radiant Point B affect the Fund of the Eye, in the same Manner as if the Pupil had had no Breadth, or as if the Radiant itself had only emitted one single Ray, such as were equal in Power to all those between B E and B F.

In like Manner the Rays proceeding from the Point A, will be so refracted in passing through the Humours of the Eye, as to meet near the Point X; and the Rays from any intermediate Point between A and B, will nearly meet in some other Point in the Fund of the Eye between X and O.

Upon the whole it may be asserted universally, that every Point of an Object affects only one Point in the Fund of the Eye; and, on the contrary, that every Point in the Fund of the Eye only receives Rays from one Point of the Object. Though this is not to be understood in the utmost Rigour.

Now if the Object recede from the Eye in such Manner, as that the radiant Point B does not decline from the Line B D; the Rays which should proceed from B, not enough divaricated, would be so refracted in passing the three Surfaces, as that they would meet ere they reached the Point O: On the contrary, if the Object should be brought nearer the Eye, the Rays passing from the Point B in the Pupil, too much divaricated, would be refracted so as not to meet till beyond the Point O; may the Object may be so near, that the Rays proceeding from any Point may be divaricated, as that they shall

shall never meet at all. In all which Cases, there would be no Point of the Object, but would move a pretty large Portion of the Fund of the Eye; and thus the Action of each Point would be confounded with that of the contiguous one.

And this would commonly be the Case, but that Nature has provided against it; either by contriving the Eye, so as its Bulb may be lengthen'd or shorten'd, as Objects may be more or less distant; or, as others will have it, so as that the Cryſtalline may be made more convex, or more flat; or, according to others, so as that the Distance between the Cryſtalline and the Retina, may be lengthen'd or shorten'd.

The first Expedient is the most probable; on the Footing of which, when we direct our Eyes to an Object so remote, as that it cannot be distinctly viewed by the Eye in its accustom'd Figure, the Eye is drawn back into a flatter Figure, by the Contraction of four Muscles; by which Means, the Retina becoming nearer the cryſtalline Humour, receives the Rays sooner: And when we view an Object too near, the Eye being compressed by the two oblique Muscles, is render'd more globular; by which Means, the Retina being set further off from the Cryſtalline, does not receive the Rays of any Point before they meet.

It may be here added, that this Access, and Recess of the Cryſtalline, is so necessary to Vision, that whereas in some Birds the Coats of the Eye are such a bony Consistence, that Muscles would not have been able to contract or distend them; Nature has taken other Means, by binding the Cryſtalline down to the Retina, with a Kind of blackish Threads, not found in the Eyes of other Animals. Nor must it be omitted, that of the three Refractions above-mentioned, the first is wanting in Fishes; and that to remedy this, their Cryſtalline is not lenticular, as in other Animals, but globular. Lastly, since the Eyes of old People are generally worn flatter than those of young ones; so that the Rays from any Point, fall on the Retina, ere they become collected into one; they must exhibit the Object somewhat confusedly: Nor can such Eyes see any but remote Objects distinctly.

Note, That those who have the Cryſtalline of the Eye thus configured, are called *Presbytae*. This Defect is helped only with Convex-Glasses or Spectacles; which will make the Rays converge sooner, and if they are well fitted, fall exactly on the Retina. If the Distance between the Retina and the Cryſtalline be too small, the Person will likewise be a *Presbyta*. The Word is formed from the Greek *πρεσβυς*, *Senex*; because old People are naturally subject to this Defect; Time, and the Friction of the Eye-lids, &c. gradually wearing the Ball flat.

In others, whose Eyes are too globular, the Case is just the Reverse; and these are called *Myopes*.

From what has been shewn, that every Point of an Object moves only one Point of the Bottom of the Eye; and, on the contrary, that every Point in the Fund of the Eye, only receives Rays from one Point of the Object; it is easy to conceive, that the whole Object moves a certain Part of the Retina; that in this Part there is a distinct and vivid Collection of all the Rays received in at the Pupil; and that as each Ray carries its proper Colour along with it, there are as many Points pointed in the Fund of the Eye, as there are Points visible in the Object. Thus is there a Species or Picture, on the Retina, exactly like the Object; all the Difference between them is, that a Body is here represented by a Surface; a Surface frequently by a Line, and a Line by a Point: That the Image is inverted, the right Hand answering to the left of the Object, &c. and that it is exceedingly small, and still the more so, as the Object is more remote.

What we have shewn of the Nature of Light and Colours, readily accounts for this Painting of the Object on the Retina. The Matter of Fact is proved by an easy Experiment first tried by *Des Cartes*; thus, the Windows of a Chamber being shut, and Light only admitted at one little Aperture; to that Aperture apply the Eye of some Animal newly killed, having first dextrously pulled off the Membranes that cover the Bottom of the vitreous Humour, viz. the hind Part of the Sclerotica,

Choroides, and even Part of the Retina; then will the Images of all the Objects, without Doors, be seen distinctly painted on any white Body, as on an Egg-Shell, that the Eye is laid upon. The same Thing is better shewn by an artificial Eye, or *Camera obscura*.

The Images of Objects, then, are represented on the Retina; which is only an Expansion of the fine Capillaments of the *Optick* Nerve, and from which the *Optick* Nerve is continued in the Brain. Now any Motion or Vibration, expressed on one Extreme of the Nerve, will be propagated to the other: Hence the Impulse of the several Rays, sent from the several Points of the Object, will be propagated as they are on the Retina (*i. e.* in their proper Colours, &c. or in particular Vibrations, or Manners of Pressure corresponding thereto) to the Place where those Capillaments are interwoven into the Substance of the Brain. And thus is Vision brought to the common Case of Sensation.

For such we know is the Law of the Union between the Soul and Body; that certain Perceptions of the first do necessarily follow certain Motions of the last: But the different Parts of the Object do separately move different Parts of the Fund of the Eye; and those Motions are propagated to the Sensory: It follows, therefore, that there must arise so many distinct Sensations at the same Time.

Hence, 1. We easily conceive, that the Perception, or Image in the Mind, must be the clearer and most vivid, the more Rays the Eye receives from the Object: Consequently the Largeness of the Pupil will have some Share in the Clearness of Vision.

2. Considering only one radiant Point of an Object, we may say, that that Point would move the Sense more weakly, or be seen more obscurely, as it is more remote; by Reason the Rays coming from any Point, like all Qualities propagated *in Orbem*, are always diverging; and therefore the more remote, the fewer of them will be received in at the Pupil. But as it is not a single Point of an Object, but all of them together, that affect the Organ of Sense; and as the Image of the Object still possesses a less Part of the Retina, as it is more remote; therefore, though the Rays that flow from any Point of an Object two Miles off, into the Pupil, be rarer, or fewer by half, than those flowing from the same Point at a Mile's Distance, yet the same Capillaments of the *Optick* Nerve, which, in the latter Case, would only be moved by that one Point, in the former, will be affected with the joint Action of the neighbouring Points; and therefore the Image be as clear as in the other Case. Add, that the Pupil dilating itself more, as the Object is more remote, takes in more Rays than it would otherwise do.

3. The Distinctness of Vision, is somewhat concerned in the Size of the Image, exhibited in the Fund of the Eye. For there should be, at least, as many Extrems of Capillaments, or Fibres of the *Optick* Nerve, in the Space that Image possesses, as there are Particles in the Object, that sends Rays into the Pupil: Otherwise every Particle will not move its separate Capillament: And if the Rays from two Points fall on the same Capillament, it will be the same, as if only one Point had fell there; since the same Capillament cannot be differently moved at the same Time. And hence it is, that the Images of very remote Objects being very small, they appear confused, several Points of the Image affecting each Capillament: And hence also, if the Object be of different Colours, several Particles affecting the same Capillament at the same Time, only the brightest and most lucid will be perceived: Thus a Field, furnished with a good Number of white Flowers, among a much greater Quantity of green Grass, &c. at a Distance, appears all white.

Our seeing of Objects *simple*, though with two Eyes, in each of which is a several Image, or Picture; and our seeing of them *erect*; whereas the Picture inverted, are two other very great Difficulties in the *Theory of Vision*.

As to our seeing Objects *single*, though with two Eyes, &c. the best Anatomists differ greatly about the Cause thereof. *Galen*, and others after him, ascribe it to a Coalition or Decussation, of the *Optick* Nerve, behind the *Os Sphenoides*. But whether they decussate, or coalesce, or only barely touch one another, is not so well agreed. The *Bartholines* and *Vesalius*, say expressly, they are united

united by a perfect Confusion of their Substance: Dr. *Gibson* allows them to be united by the closest Conjunction, but not Confusion of their Fibres.

Des Cartes, and others, account for the Effect another Way, *viz.* by supposing that the Fibrillæ constituting the medullary Part of those Nerves, being spread in the Retina of each Eye, have each of them corresponding Parts in the Brain; so that when any of those Fibrillæ are struck by any Part of an Image, the corresponding Parts of the Brain are affected thereby. Somewhat like which is the Opinion of Dr. *Briggs*, who takes the *Optick* Nerve of each Eye to consist of homologous Fibres, having their Rise in the *Thalamus Nervica Opticorum*, and thence continued to both the Retina, which are composed of them: And further, that those Fibrillæ have the same Parallelism, Tension, &c. in both Eyes; consequently when an Image is painted on the same corresponding, sympathizing Parts of each Retina, the same Effects are produced, the same Notice carried to the *Thalamus*, and so imparted to the Soul. Hence that double Vision ensuing upon an Interruption of the Parallelism of the Eyes; as when one Eye is depressed by the Finger, or their Symphony interrupted by Disease. But Dr. *Briggs* maintains, that it is but in few Subjects there is any Decussation; in none any Conjunction more than mere Contact.

Whence it is that we see Objects *erect*, when it is certain the Images thereof are painted invertedly on the Retina. *Des Cartes* accounts for it hence; that the Notice the Soul takes of the Object, does not depend on any Image, nor on any Action coming from the Object, but merely on the Situation of the minute Parts of the Brain, whence the Nerve arises. As for Example, the Situation of a Capillament of the *Optick* Nerve, corresponds to a certain Part of the Brain, which occasions the Soul to see all those Places lying in a right Line therewith.

But M. *Molyneux* gives us another Account: The Eye, he observes, is only the Organ, or Instrument; it is the Soul that sees. To enquire then, how the Soul perceives the Object erect by an inverted Image, is to enquire into the Soul's Faculties. Again, imagine that the Eye receives an Impulse on its lower Part, by a Ray from the upper Part of an Object; must not the visive Faculty be hereby directed to consider this Stroke as coming from the Top rather than the Bottom of the Object, and consequently be determined to conclude it, the Representation of the Top?

My own Sentiment is, that as it is the Soul, which not only operates (all our external Faculties being nothing else but imbecil Instruments, without its Influences or Concourse) but unfolds likewise all our Actions, from that Chaos they are promiscuously confounded in, at the first Instant of their Existence, to appropriate each of them to the instrumental Faculty it is attributed to, in order to render them discernible; when it perceives any of those Operations imperfect or irregular, it rectifies it; therefore when she is struck with an inverted Image; in the second Instant of that Vision, she conceives the Irregularity of its Situation; and in the third changes the Rays, which represented it such, and which had first struck the Retina, to bring it to its natural Situation, in the same Manner as when we suffer in any of our Members, she appeases the Anguish, which often, was it left to itself, would become insupportable.

Besides Light and Colours, which we have consider'd as the *proper* and *adequate Objects of Vision*, and which are no other Way perceivable, but by Sight alone; Philosophers admit another Sort of *Visibles*, which they call *common*, and which are subject to divers Senses, as the Sight, Hearing, Feeling, &c.

Aristotle, *de Anima*, lib. 2. enumerates five Kinds of *common Visibles*, which are usually received for such in the Schools, *viz.* Motion, Rest, Number, Figure, and Magnitude. Others maintain nine, contained in the following Verses.

*Sunt objecta novem visus communia: quantum,
Inde figura, locus, sequitur distantia, situs,
Continuumque & discretum, motusque, quiesque.*

Authors reason very variously as to these common Objects of Vision: There are two principal Opinions among

the Schoolmen. The Adherents to the first, hold, that the *common Visibles* produce proper Representations of themselves, by some peculiar Species or Image, whereby they are formerly perceived independently of the proper Visibles.

But the second Opinion prevails most, which is, that the *common Visibles* have not any such formal peculiar Species, to become visible by; but that the proper Objects are sufficient to shew themselves in this or that Place, or Situation, or in this, or that Distance, Figure, Magnitude, &c. by the Circumstances of their Conveyance to the Sensory.

In Effect, since these *common Visibles* cannot be represented alone (for whoever saw Place, Distance, Figure, Situation, &c. of itself) but are always conveyed along with the Images of Light and Colour to the Organ; what Necessity is there to conceive any such proper Images, whereby the *common Visibles* should be formally perceived by the Soul? It is much more probable, that from the peculiar Manner, wherein the sensitive Faculty perceives a proper Object, it is apprized of its being in this or that Situation, or Place; in this or that Figure, Magnitude, &c. How this is effected, may be conceived from what follows.

I. The Situation and Place of visible Objects, are perceived without any intentional Species thereof, merely by the Impulse being made from a certain Place and Situation, either above or below, on the right or left, before or behind; whereby the Rays of the proper *Visibles* are thrown upon the Retina, and their Impression conveyed to the Sensory.

For since an Object is seen by those Rays, which carry its Image to the Retina, and in that Place to which the visive Power is directed, by the Rays it receives: As it perceives the Impulse of the Rays to come from any Place, &c. It is abundantly admonished of the Object being in that Place and Situation.

From this Principle, several remarkable Phenomena of Vision are accountable for; as,

1. That if the Distance between two visible Objects, be an Angle that is insensible, the distant Bodies will appear as if contiguous: Whence a continuous Body being the Result of several contiguous ones; if the Distances between several Visibles subtend insensible Angles, they will appear one continuous Body: Which gives a pretty Illustration of the Notion of a Continuum.

2. If the Eye be placed above an horizontal Plane, Objects, the more remote they are, the higher will they appear, till the last be seen in a Level with the Eye. Whence it is, that the Sea, to Persons standing ashore, seems to rise higher and higher the further they look.

3. If any Number of Objects be placed below the Eye, the most remote will appear the highest; if they be above the Eye, the most remote will appear the lowest.

4. The upper Parts of high Objects appear to stoop, or incline forwards; as the Fronts of Churches, Towers, &c. And Statues a-top of Buildings, to appear upright, must recline, or bend backwards.

II. The Mind perceives the Distance of visible Objects, from the different Configurations of the Eye, and the Image impressed thereon.

For the Eye disposes itself differently, according to the different Distances it is to see, *viz.* for remote Objects the Pupil is dilated, and the Crystalline brought nearer the Retina, and the whole Eye made more globous: On the contrary, for near Objects, the Pupil is contracted, the Crystalline thrust forwards, and the Eye lengthen'd.

The Distance again, is adjudged of by the Angle the Object makes, from the distinct or confused Representation of the Object, and the Briskness or Feebleness of the Rarity, or Spissitude of the Rays.

To this it is owing, 1. That Objects which appear obscure or confused, are judged to be more remote; a Principle which the Painters use, to make some of their Figures appear further distant, than others in the same Plane.

To this it is likewise owing, that Rooms whose Walls are whitened appear the smaller: That Fields covered with Snow, or white Flowers, shew less than when clothed with Grass: That Mountains covered with
snow,

Snow, in the Night-time, appear the nearer; that opaque Bodies appear the more remote in the Twilight.

III. The Quantity or Magnitude of visible Objects, is known chiefly by the Angle comprehended between two Rays drawn from the two Extremes of the Object, to the Center of the Eye.

An Object appears so big as is the Angle it subtends; or Bodies seen under a greater Angle appear greater; and those under a less, &c.—Hence the same Things appear now bigger, and now less, as it is more or less distant from the Eye.—This we call *apparent Magnitude*.

Now, to judge of the real Magnitude of an Object, we consider the Distance; for since a near and remote Object may appear under equal Angles, the Distance must necessarily be estimated; that if it be great, and the optick Angle small, the remote Object may be judged great, and *vice versa*.

The Magnitude of visible Objects, is brought under certain Laws demonstrated by the Mathematicians; as,

1. That the apparent Magnitudes of a remote Object, are as the Distances reciprocally.

2. That the Cotangent of half the apparent Magnitude of the same Objects are as the Distances; hence, the apparent Magnitude and Distance being given, we have a Method of determining the true Magnitude: The Canon is this, as the whole Sine is to the Tangent of half the apparent Magnitude, so is the given Distance to half the real Magnitude. The same Canon, inverted, will from the Distance and Magnitude given, determine the apparent one.

3. Objects seen under the same Angle, have their Magnitudes proportional to their Distances.

4. The subtense Angle of any Arch of a Circle, appears of equal Magnitude in all the Points, though one Point be vastly nearer than another, and the Diameter appears of the same Magnitude in all the Points of the Periphery of the Circle. Hence we take a pretty Hint for the most commodious Form of Theatres.

5. The Eye being placed in any Angle of a regular Polygon, the Sides will appear equal.

6. If the Magnitude of an Object directly opposite to the Eye, be equal to its Distance from the Eye, the whole Object will be taken in by the Eye, but nothing more. Whence the nearer you approach an Object, the less Part you see of it.

IV. The Figure of visible Objects is estimated chiefly from our Opinion of the Situation of the several Parts thereof.

This Opinion of the Situation, &c. enable the Mind to apprehend an external Object under this or that Figure, more justly than any Similitude of the Images in the Retina with the Object can; the Images being frequently elliptical, oblong, &c. when the Objects they exhibit to the Mind are Circles, Squares, &c.

The Laws of Vision, with regard to the Figures of visible Objects, are,

1. That if the Center of the Pupil be exactly against, or in the Direction of a Right Line, the Line will appear as one Point.

2. If the Line be placed in the Direction of a Surface, so that only one Line of the Perimeter can radiate on it, it will appear as a Line.

3. If a Body be opposed directly towards the Eye, so as only one Plane of the Surface can radiate on it, it will appear as a Surface.

4. A remote Arch, viewed by an Eye in the same Place, will appear as a Right-Line.

5. A Sphere viewed at a Distance appears a Circle.

6. Angular Figures at a Distance appear round.

7. If the Eye look obliquely on the Center of a regular Figure, or a Circle, the true Figure will not be seen; but the Figure will appear oval.

V. The Number of visible Objects is perceived, not only by one or more Images formed in the Fund of the Eye; but also by such Opposition of those Parts of the Brain, whence the optick Nerves spring, as the Mind has been used to, in attending to a certain Place, and that either single or manifold.

Accordingly when either of the Eyes, with the contiguous Part of the Brain, are forced out of their just Parallelism with the other, *v. gr.* by pressing it with

the Finger, &c. all Things appear double: But when they are in the requisite Parallelism, though there be two Images in the Fund of the two Eyes, yet the Object will appear single.—Again; one Thing may appear double, or even manifold, not only with both Eyes, but even with only one of them open; by reason the common Concourse of the Cones of the Rays, reflected from the Object to the Eye, either falls short of the Retina or goes much beyond it.

VI. Motion and Rest are seen, when the Images of Objects represented in the Eye, and propagated to the Brain, are either moved or at Rest: And the Mind perceives these Images either moving or at Rest, by comparing the moved Image to another, with respect to which it changes Place; or by the Situation of the Eye to the Object being continually changed.

So that Motion is only perceived by perceiving the Images to be in different Places and Situations: Nor are these Changes perceived unless effected in Time. So that to perceive Motion a sensible Time is required. But Rest is perceived by the usual Faculty, from the Perception of the Image in the same Place of the Retina, and the same Situation for some sensible Time.

Hence, the Reason why Bodies moving exceedingly fast appear at Rest: Thus a live Coal swung briskly round, appears a continued Circle of Fire; the Motion not being commensurate with visible Time, but much swifter than the same: So that in the Time the Soul requires to judge of any Change of Situation of the Image on the Retina, or that it is moved from this Place to that, the Thing itself performs its whole Circuit, and is in its former Place again.

The Laws of Vision, with regard to the Motion of VISIBLES, are, 1. That if two Objects unequally distant from the Eye, move from it with equal Velocity, the more remote one will appear, the slower; or if their Celerities be proportionable to their Distances, they will appear to move equally swift.

2. If two Objects, unequally distant from the Eye, move with unequal Velocities in the same Direction, their apparent Velocities are in a Ratio compounded of the direct Ratio's of their true Velocities, and the reciprocal ones of their Distances from the Eye.

3. A visible Object, moving with any Velocity, appears to be at Rest, if the Space described in the Interval of one Second be imperceptible at the Distance of the Eye. Hence it is that a near Object, moving very slowly, as the Index of a Clock, or a remote one very swiftly, as a Planet, seem at Rest.

4. An Object moving with any Degree of Velocity will appear to rest, if the Place it runs over in a Second of Time, be to its Distance from the Eye, as 1 to 1400, nay, in fact, if it be as 1 to 1300.

5. The Eye proceeding straight, from one Place to another, a natural Object, either on the Right or Left, will seem to move the contrary Way.

6. If the Eye and the Object move both the same Way, only the Eye much swifter than the Object, that last will appear to go backwards.

7. If two or more Objects move with the same Velocity, and a third remains at rest, the Moveables will appear fixed, and the Quiescent in Motion the contrary Way.—Thus Clouds moving very swiftly, their Parts seem to preserve their Situation, and the Moon to move the contrary Way.

If the Eye be moved with a greater Velocity, lateral Objects at Rest, appear to move the contrary Way.—Thus to a Person sitting in a Coach, and riding briskly through a Wood, the Trees seem to retire the contrary Way; and to People in a Ship, &c. the Shores seem to recede.

Note, That the *apparent Magnitude* above-mentioned, and conceived as one of the *common VISIBLES*, is that measured by the optick or visual Angle, intercepted between Rays drawn from its Extremes to the Center of the Pupil of the Eye.

The *apparent Magnitudes* of the two great Luminaries, the Sun and Moon, at Rising and Setting, are Phenomena that have extremely embarrassed the modern Philosophers. According to the ordinary Laws of Vision, they should appear the least when nearer the

Horizon, as being then furthest distant from the Eye ; and yet we find the contrary true in Fact. *Ptolemy*, in his *Almagest*, lib. 1, 2, 3, ascribed this Appearance to a Refraction of the Rays by Vapours, which actually enlarge the Angle under which the Moon appears, just as the Angle is enlarged by which an Object is seen from under Water: And his Commentator *Theon* explains distinctly how the Dilatation immersed in Water is caused. But it was afterwards discover'd, that there is no Alteration in the Angle ; upon which another Solution was started by the Arab *Alhazen* ; and followed and improved by *Vitellio*, *Kepler*, *Peckam*, *Rog. Bacon*, and others, according to *Alhazen*, the Sight apprehends the Surface of the Heavens as flat, and judges of the Stars, as it would of ordinary visible Objects, extended upon a wide Plain ; that the Eye sees them under equal Angles, but withal perceives a Difference in their Distances, and (on account of the Semi-Diameter of the Earth, which is interposed in one Case, and not in the other) that it is hence induced to judge those which appear more remote to be greater. *Des Cartes*, and from him Dr. *Wallis*, and most other Authors, account for the Appearance of a different Distance under the same Angle from a long Series of Objects interposed between the Eye, and the Extremity of the sensible Horizon, which make us imagine it more remote than when in the Meridian, where the Eye sees nothing in the Way between the Object and itself. This Idea of a great Distance, makes us imagine the Luminary the bigger : For any Object being seen under any certain Angle, and believed, at the same Time, very remote, we naturally judge it must be very large, to appear under such an Angle, at such a Distance. And thus a pure Judgment of the Mind makes us see, the Sun or the Moon bigger in the Horizon, than in the Meridian, notwithstanding their Images painted in the Retina, are less in the former Situation than the latter.

This Hypothesis *F. Gouye* destroys, by observing, that the narrower and more confined the sensible Horizon is, the greater does the Sun and Moon appear ; the contrary of which should happen on the Principle laid down.

Gassendus is of Opinion, that the Pupil of the Eye, which is always more open as the Place is more dark ; being more so in the Morning and Evening than at other Times, by Reason the Earth is covered with gross Vapours ; and besides, being obliged to pass through a longer Column or Series of Vapours, to reach the Horizon ; the Image of the Luminary enters the Eye at a greater Angle, and is really painted there larger at the former Time. In answer to which, it may be said, that notwithstanding this Dilatation of the Pupil, occasioned by the Obscurity ; if the Moon be viewed through a little Pin-Hole, made in Paper, she appears less when in the Horizon than in the Meridian. *F. Gouye*, finding both the Conjectures false, advances a third ; which is, that when the Luminaries are in the Horizon, the Neighbourhood of the Earth, and the gross Vapours wherewith they appear enveloped, have the same Effect with Regard to us, as a Wall, or other dense Body placed behind a Column, which in that Case appears bigger than when insulate, and encompassed on all Sides with an illumined Air. Farther it is observed, that a Column when fluted, appears bigger than before, when it was plain ; the Flutes being so many particular Objects, which by their Multitude occasion the Mind to imagine the whole Object, whereof they are composed of a larger Extent. The same Thing may be said of the several Objects seen towards the Horizon, to which the Sun or Moon correspond at their Rising and Setting. And hence it is, that they appear longer still, when they Rise or Set between Trees ; the narrow, yet distant Intervals whereof, have the same Effect with Regard to the apparent Diameter of the Luminary, as a greater Number of Flutes, with Regard to the Shaft of a Column.

Note also, That having thus clearly and distinctly explained the first Principles and Rudiments of *Optick*, with Regard to the speculative Part thereof ; I'll next

reduce all those Rules into Practice, and shew by plain Demonstration, that they are true and well founded, by Means of the *Catoptricks* and *Dioptricks* ; therefore,

CATOPTICKS, is that Branch of *Opticks*, which delivers the Laws of Light reflected from *Mirrors*, or *Specula*.

Mirror, in *Catoptricks*, denotes any polished Body impervious to the Rays of Light, and which of Course reflects them equally.

Note, That the Doctrine of *Mirrors* is founded on the following general Principles. 1. Light reflected from any *Mirror*, or *Speculum*, makes the Angle of Incidence equal to that of Reflection. Hence a Ray of Light falling perpendicularly on the Surface of a *Speculum*, will be reflected back upon itself. Which we find by Experience it actually does. From the same Point of a *Mirror*, therefore, there cannot be several Rays reflected to the same Point ; since in that Case, all the Angles of Reflection must be equal to the same Angle of Incidence, and therefore to each other ; which is absurd ; nor can the Ray be reflected to two or more Points ; since in that Case, all the Angles of Reflection, would be equal to the same Angle of Incidence : Which is likewise absurd.

2. From every Point of a *Mirror*, are reflected Rays thrown on it, from every Point of a radiant Object. Since then Rays coming from different Parts of the same Object, and striking on the same Point of the *Mirror*, cannot be reflected back to the same Point ; the Rays which flow from different Points of the same radiating Object, are again separated after Reflection : So that each Point shews whence it came. Hence it is, that the Rays reflected from *Mirrors*, exhibit the Objects to View. Hence also it appears, that rough uneven Bodies must reflect the Light in such a Manner, as that Rays coming from different Points will be blended or thrown confusedly together.

MIRRORS, are commonly divided into *Plane*, *Concave*, *Convex*, *Cylindrical*, *Conical*, *Parabolical*, and *Elliptical*.

Plane MIRRORS are those which have a Plane or flat Surface, commonly called *Looking Glasses* ; the Manner of making which I have given in my *Treatise of Glass-Grinding*, under the Letter G.

The Laws or Phænomena of *plain Mirrors*, are as follows. 1. Every Point of an Object is seen in the Intersection of the *Cathetus* of Incidence, with the reflected Ray.

Note, That the *Cathetus* of Incidence, in *Catoptricks*, is a right Line drawn from a radiant Point, perpendicular to the reflecting Line, or the Plane of the *Speculum* or *Mirror*. The *Cathetus* of Reflection, or of the Eye, is a right Line drawn from the Eye, or from any Point of a reflected Ray, perpendicular to the Plane of Reflection, or of a *Speculum*.

Hence, 1. As all the reflected Rays meet with the *Cathetus* of Incidence in the Intersection ; by whatever reflected Ray the radiant Point be seen, it will still appear in the same Place. Consequently any Number of Persons viewing the same Object in the same *Mirror*, will all see it in the same Place behind the *Mirror*. And hence it is, that the same Object has only one Image, and that we do not see it double with both Eyes.

Hence also the Distance of the Image from the Eye, is compounded of the Ray of Incidence, and the reflected Ray : And the Object radiates reflectedly, in the same Manner as it would do directly, were it removed into the Place of the Image.

2. The Image of a radiant Point, appears just so far behind a *plain Mirror*, as the radiant Point is before it.

Hence, if the *Mirror*, A G, *Table Opticks*, fig. 1. be placed horizontal, the Point A will seem so much below the Horizon as it is really elevated above it ; consequently erect Objects will appear as if inverted ; and therefore Men standing on their Feet as if on their Heads, or if their *Mirror* be fastened to the Ceiling of a Room, parallel to the Horizon, Objects on the Floor will appear above the Ceiling as much as they really are below it ; and that upside-down.

3. In a *plain Mirrour*, the Images are perfectly similar and equal to the Objects. And hence they are us'd as Looking-Glasses.

4. In a *plain Mirrour*, Things on the Right-Hand appear as on the Left, and *vice versa*.

Hence also we have a Method of measuring any inaccessible Altitude by means of a *plain Mirrour*.—Thus the *Mirrour* being placed horizontally in C, fig. 16. retire from it till such Time as the Top of the Tree be seen therein. Measure the Height of the Eye DE, the Distance of the Station from the Point of Reflection EC, and the Distance of the Foot of the Tree from the same. Then to EC, CB, and ED, find a fourth Proportional AB. This is the Altitude sought.

5. If a *plain Mirrour* be inclined to the Horizon, in an Angle of 45 Degrees, an Object perpendicular to it will appear parallel, and an horizontal Object perpendicular.

And hence the Eye being placed beneath the *Mirrour*, the Earth will appear perpendicularly over it; or if placed over it, the Earth will appear perpendicularly under it. Hence also a Globe descending down a Plane a little inclined, may, by means of a *Mirrour*, be exhibited as mounting up a vertical Plane, to the great Surprise of such as are unacquainted with *Catoptricks*.—And hence we have a Method of representing ourselves as if flying. For a *Mirrour* inclined to the Horizon under an Angle of 45°, we have observed, will represent vertical Objects as if horizontal. Consequently a large *Mirrour* being so disposed, as you advance towards it, you will seem to move horizontally; and nothing will be wanting to the Appearance of flying, but to strike out the Arms and Legs. It must be added however, that as the Floor is elevated along with you, your Feet will still be seen to walk as along a vertical Plane. To deceive the Eye entirely, therefore, it must be kept from the Feet.

6. If the Object be parallel to the Speculum, and equally distant from it, with the Eye; the reflecting Line will be half the Length of the Object.

And hence to be able to see the whole Body in a *plain Mirrour*, its Height and Breadth must be half your Height and Breadth. Consequently the Height and Breadth of any Object to be seen in a *Mirrour*, being given; we have also the Height and Breadth of the *Mirrour* wherein the whole Object will appear at the same Distance with the Eye.

Hence also, as the Length and Breadth of the reflecting Parts of the Speculum, are subduple of those of the Object to be reflected; the reflecting Part of the *Mirrour*, is to the Surface reflected in a sub-quadruple Ratio. Consequently, the reflecting Portion being a constant Quantity; if any Place you see the whole Body in a *Mirrour*, you will see it in every other Place, whether you approach nearer or recede further from it.

7. If several *Mirrors*, or several Fragments, or Pieces of a *Mirrour* be all disposed in the same Plane, they will only exhibit an Object once.

8. If two *plain Mirrors*, or Specula, meet in any Angle; the Eye placed within that Angle, will see the Image of an Object placed within the same, as often repeated as there may be Catheti drawn, determining the Places of the Images, and terminated without the Angle.

Hence as the more Catheti terminated without the Angle may be drawn as the Angle is more acute; the acuter the Angle the more numerous the Images. Thus Z. Traler found at one Angle of one Third of a Circle, the Image was represented twice, at $\frac{1}{3}$ thrice, at $\frac{1}{4}$ five Times, and at $\frac{1}{5}$ eleven Times.

Further, if the *Mirrors* be placed upright, and so contracted, or if you retire from them or approach to them, till the Images reflected by them coalesce, or run into one, they will appear monstrously distorted: Thus if they be at an Angle somewhat greater than a right one, the Image of your Face will appear with only one Eye; if the Angle be less than a right one, you will see three Eyes, two Noses, two Mouths, &c. at one Angle still less the Body will have two Heads. At an Angle somewhat greater than a right one, at the Distance of four Feet, the Body will be headless, &c.—Again, if the *Mirrors* be placed one parallel to the Horizon, the other inclined to it, or declined from it, it

is easy to perceive that the Images will be still more romantick.—Thus one being more declined from the Horizon to an Angle of 144°, and the other inclined to it; a Man sees himself standing with his Head to another's Feet.

Hence it appears how *Mirrors* may be managed in Gardens, &c. so as to convert the Images of those near them into Monsters of various Kinds: And since Glass *Mirrors* will reflect the Image of a lucid Object twice or thrice; if a Candle, &c. be placed in the Angle between two *Mirrors*, it will be multiplied an infinite Number of Times.

On this Principle are founded various catoptrick Machines, some of which represent Objects infinitely multiplied and distorted; others infinitely magnified, as the *catoptrick Cystula*, &c.

The *catoptrick Cystula*, is a Machine or Apparatus, whereby little Bodies are represented extremely large, and near ones extremely wide, and diffused through a vast Space, with other agreeable Phenomena; by means of *Mirrors*, disposed by the Laws of *Catoptricks*, in the Concavity of a Kind of Chest.

Of these there are various Kinds accommodated to the various Intentions of the Artificer; some multiply the Objects, some deform them, some magnify them, &c. The Structure of one or two of them will suffice to shew how infinite more may be made.

To make a *Catoptrick Cystula* to represent several Scenes of Objects, when looked in at different Foramina or Holes. Provide a polygonous Cistula, or Chest, of the multilateral Prism A B C D E F (Plate Opticks, Fig. 17.) and divide its Cavity by diagonal Planes E B, F C, D A, intersecting each other in the Center, into as many triangular Locules or Cells, as the Chest has Sides. Line the diagonal Planes with *plain Mirrors*, in the lateral Planes make round Holes, through which the Eye may peep within the Locules of the Chest. The Holes are to be covered with plain Glasses, ground within-side, but not polished, to prevent the Objects in the Locules from appearing too distinctly. In each Locule are placed the different Objects, whose Images are to be exhibited; then covering up the Top of the Chest with a thin transparent Membrane, or Parchment, to admit the Light, the Machine is compleat.

For from the Laws of Reflection it follows, that the Images of Objects, placed within the Angles of *Mirrors*, are multiplied, and appear some more remote than others; whence the Objects in one Locule will be seen, but those multiplied and diffused through a Space much larger than the whole Chest. Thus every new Hole will afford a new Scene: According to the different Angles the *Mirrors* make with each other, the Representations will be different; if they be at an Angle greater than a right one, the Images will be monstrous, &c.

The Parchment that covers the Machine, may be made pellucid, by washing it several Times in a very clear Lye, then in fair Water, and bracing it tight, and exposing it to the Air to dry. If it be desired to throw any Colour on the Objects, it may be done by colouring the Parchment. Zabnius recommends Verdigrease ground in Vinegar, for green; Decoction of Brasil Wood, for red, &c. He adds, it ought to be varnished to make it shine.

To make a *Catoptrick Cistula*, to represent the Objects within it prodigiously multiplied, and diffused through a vast Space. Make a Polygonous Cistula, or Chest, as before, but without dividing the inner Cavity, into any Apartments or Locules. Line the lateral Planes with *plain Mirrors*, and at the Foramina or Apertures, pare off the Tin and Quicksilver, that the Eye may see through: Place any Object in the Bottom, v. gr. a Bird in a Cage, &c. Here the Eye looking through the Apertures, will see each Object placed at Bottom, vastly multiplied, and the Images removed at equal Distances from one another. Hence where a large multangular Room, in a Prince's Palace, lined with large *Mirrors*, over which were plain pellucid Glasses to admit the Light; it is evident the Effects would be very surprising and magnificent.

Convex MIRRORS, are those whose Surface is convex; meaning by convex Surfaces, such as are spherically convex.

Note,

Note, That there are divers Methods used by divers Artists, for preparing or making *convex Mirrours*, particularly as to the Matter and Composition. One of the best that is known is given us by *Wolffius*, thus: Melt one Part of Tin, another of Marcasite together, and to the melted Mass add two Parts of Mercury; as soon as the Mercury begin to evaporate into Smoke (which it presently does) the whole Compost is to be thrown into cold Water, and when well cooled, the Water decanted off. The Mixture is then to be strained through a Linen Cloth in two or three Folds; and what is thus fecerned, poured into the Cavity of a Glass Sphere: This Sphere is to be turned gently round its Axis, till the whole Surface is covered; the rest being reserved for future Use. If the Sphere were of colour'd Glass, the *Mirroure* will be so too. And in the same Manner, may conick, elliptick, cylindrick, and other *Mirrours* be made.

As to the Laws or Phænomena of *convex Mirrours*.

1. In a spherical *convex Mirroure*, the Image of a radiant Point appears between the Center and the Tangent; but nearer to the Tangent than the Center.

Hence the Distance of the Object from the Tangent, is greater than that of the Image; and consequently the Object is further distant from the *Speculum*, than the Image.

2. If the Arch intercepted between the Point of Incidence, and the *Cathetus*; or the Angle formed in the Center of the *Mirroure*, by the *Cathetus* of Incidence, and that of Obliquation, be double the Angle of Incidence; the Image will appear on the Surface of the *Speculum*.

3. If the Arch intercepted between the Point of Incidence, and the *Cathetus*; or the Angle formed in the Center of the *Mirroure* by the *Cathetus* of Incidence, and the *Cathetus* of Obliquation, be more than double the Angle of Incidence; the Image will be without the *Mirroure*.

4. If the Arch intercepted between the Point of Incidence, and the *Cathetus*; or the Angle formed in the Center of the *Mirroure*, by the *Cathetus* of Incidence, and that of Obliquation, be less than double the Angle of Incidence; the Image will appear within the *Speculum*.

5. In a *concave Mirroure*, a remoter Point is reflected, from a Point nearer the Eye, than any nearer Point in the same *Cathetus* of Incidence.

6. A nearer Point, not in the same *Cathetus*, with a remoter, is reflected to the Eye, from a nearer Point of the *Speculum*, than the remoter.

7. In a spherical *convex Mirroure*, the Image is less than the Object.

And hence the Use of such *Mirrours* in the Art of Painting, where Objects are to be represented less than the Life.

8. In a *convex Mirroure*, the more remote the Object, the less its Image: And again, the smaller the *Mirroure*, the less the Image.

9. In a *convex Mirroure*, the right Hand is turned to the left; and the left to the right: And Magnitudes perpendicular to the *Mirroure*, appear topsy turvey.

10. The Image of a right Line, perpendicular to the *Mirroure*, is a right Line; but that of a right Line either oblique to the *Mirroure*, or parallel thereto, is convex.

11. Rays reflected from a *convex Mirroure* diverge more than if reflected from a plain *Mirroure*.

Hence Light, by being reflected from a spherical *Mirroure*, is weaken'd; and, consequently, the Effects of reflected Light, are weaker than these of direct. Hence also, *Myopes* see remote Objects more distinctly in a *convex Mirroure*, than they do directly.

Rays reflected from a *convex Mirroure* of a smaller Sphere, diverge more than if reflected from a larger. Consequently the Light is more weaken'd, and its Effects are less considerable in the former Case than in the latter.

Concave Mirrours, are those whose Surface is concave; meaning *spherically concave*.

Note, That to prepare, or make *concave Mirrours*; first, a Mould is to be provided for casting them: In order to this, take Clay well dried, pulverize and sift it; mix it up with Water, and then strain or sieve it; with this work up Horse-dung and Hair

shred very small, till the Mass be sufficiently tough; to which, on Occasion may be added Charcoal-dust, or Brick-dust well sifted. Two coarse Moulds are to be prepared of a gritty Stone, the one concave, the other convex, which are to be ground on one another, with wet Sand between, till such Time as the one perfectly fits the other. By this Means a perfect spherical Figure is acquired.—The Mass prepared before is now to be extended on the Table by means of a wooden Roller, till it be of a Thickness proper for the *Mirroure*; and then being strewed with Brick-dust, to prevent its striking, it is laid over the convex Mould, and so gets the Figure of the *Mirroure*. When this is dry it is covered with another Lay of the same Mass; which once dried, both Covers, or Segments of the hollow Sphere, made of Clay, are taken off. The innermost of the two being laid aside, the Stone-Mould is anointed with a Pigment prepared of Chalk and Milk, and the outer Cover again put over it.—Lastly, the Joining being covered over with the same Clay whereof the Cover is formed; the whole Mould is bound together with Iron Wire, and two Holes cut through the Cover, the one for the melted Matter of the *Mirroure* to be poured through, the other for the Air to escape at, to prevent the *Mirroure* being spoiled with Bubbles. The Mould thus prepared, eight Parts of Copper, one of *English* Tin, and five of Marcasite, are melted together; a little of the Mixture is taken out with a Ladle, and if it be too red when cold, more Tin is put in, if too white, more Copper: The Mass is then poured into the Mould before prepared, and so assumes the Figure of a *Mirroure*.—Some with ten Parts of Copper mix four of *English* Tin, a little Antimony and Sal Armoniack, stirring the Mass about as long as any Fumes arise from it. Others have other Compositions; many of which are described by Shotters, and Zabius. The *Mirroure* being thus cast, is cemented to a wooden Frame, and thus worked to and fro over the convex Stone Mould, first with Water and Sand; and lastly without Sand, till it be fit for polishing. The Stone Mould is then cover'd with Paper, and that smear'd over with Tripoli Dust, and Calx of Tin; Over which the *Mirroure* is worked to and fro, till it has got a perfect Polish. And in the same Manner are Glass *Mirrours* polished, excepting that the convex Surface is there worked in the concave Mould. When the *Mirrours* are very large, they are fixed on a Table, and first ground with a gritty Stone, then with Pumice, then with fine Sand, by Means of a Glass, cemented to a wooden Frame; and lastly, rubbed with Calx of Tin, and Tripoli Dust, by a wet Leather.—For *concave Mirrours* of Glass; the Mould is usually made of Alabaster: The rest as in Metal *Mirrours*.

The Laws and Phænomena of *concave Mirrours*, are,
1. If a Ray falls on a *concave Mirroure*, under an Inclination of 60 Degrees, and parallel to the Axis; the reflected Ray will concur with the Axis in the Pole of the Glass. If the Inclination of the incident Ray be less than 60 Degrees, the reflected Ray will concur with the Axis, at a Distance less than a fourth Part of the Diameter. And universally, the Distance of the Point, wherein the Ray concurs with the Axis, from the Center, is to half the Radius, in the Ratio of the whole Sine, to the Cosine of Inclination.

Hence it is gather'd by Calculation, that in a *concave spherical Mirroure*, whose Breadth subtends an Angle of six Degrees, parallel Rays meet after Reflection, in a Part of the Axis less than one thousand four hundred fifty seventh Part of the Radius: If the Breadth of the *concave Mirroure* be 6, 9, 12, 15, or 18 Degrees; the Part of the Axis wherein the parallel Rays meet, after Reflection is less than $\frac{1}{161}$, $\frac{1}{100}$, $\frac{1}{60}$, $\frac{1}{41}$, $\frac{1}{30}$ of the Radius.

And on this Principle it is that Burning-Glasses are built. For since the Rays diffused through the whole Surface of the *concave Mirroure*, after Reflection are contracted into a very small Compass; the Light and Heat of the parallel Rays must be prodigiously increased thereby, viz. in a duplicate Ratio of the Breadth of the *Mirroure*, and the Diameter of the Circle, wherein all the Rays

Rays are collected: And since the Sun's Rays are, as to any Purposes on Earth, parallel, no Wonder concave *Mirrors* should burn with such Violence.

But as the Focus of a concave *Mirror* is there where the Rays are more closely contracted, if it be a Segment of a large Sphere, its Breadth must not subtend an Arch above eighteen Degrees; if it be a Segment of a smaller Sphere, its Breadth may be thirty Degrees, which is verified by Experiment.

As the Surface of a *Mirror*, which is a Segment of a larger, receives more Rays than another of a less, if the Latitude of each subtend an Arch of 18 Degrees, or even more or less, provided it be equal: The Effects of the greater *Mirror* will be greater than those of the less.

And as the Focus is contained between the fourth and fifth Part of the Diameter, *Mirrors* that are Segments of greater Spheres, burn at a greater Distance than those which are Segments of a smaller.

Since, lastly, the *Burning* depends on the Union of the Rays, on the concave spherical Figure, it is no Wonder that even *Mirrors* gilt, or those prepared of Alabaster, &c. covered with Gold; nay, even that those made of Paper and covered with Straw, should be found to burn.

Note, That among the Antients the *burning Mirrors* of *Archimedes* and *Proelles* are eminent; by one of which the Roman Ships besieging *Siracuse*, under the Command of *Marcellus*, according to the Relations of *Zonaras*, *Tzetres*, *Galen*, *Eustathius*, &c. and by the other the Navy of *Vitalian* besieging *Bizantium*, according to the same *Zonaras*, were burnt to Ashes. Among the Moderns the most remarkable *burning Mirrors* are those of *Villette*, a Frenchman, *Settala*, and *Tschirnhausen*. *Settala*, Canon of *Padua* made a parabolick *Mirror*, which, according to *Shottus*, burnt Pieces of Wood at the Distance of 15 or 16 Paces. *M. Tschirnhausen's* *Mirror* is at least equal to the former, both in Bigness and Effect. The following Things are noted of it in the *Acta Eruditorum*: 1. Green Wood takes Fire instantaneously, so as a strong Wind cannot extinguish it. 2. Water boils immediately, and Eggs in it are presently edible. 3. A Mixture of Tin and Lead three Inches thick drops presently, and Iron or Steel Plate becomes red-hot presently, and a little after burns into Holes. 4. Things not capable of melting, as Stones, Bricks, &c. become red-hot like Iron. 5. Slates become first white, then a black Glass. 6. Tiles are converted into a yellow Glass, and Shells into a blackish yellow one. 7. A Pumice-stone emitted from a Volcano melts into white Glass: And, 8. A Piece of a Crucible also vitrifies in eight Minutes. 9. Bones are soon turned into an opaque Glass, and Earth into a black one. The Breadth of this *Mirror* is near three *Leipsick* Ells, its Focus two Ells distant from it; it is made of Copper, and its Substance is not above half the Thickness of the Back of a Knife. *Villette*, a French Artist of *Lyons*, made a large *Mirror*, bought by *Tavernier*, and presented by him to the King of *Persia*; a second bought by the King of *Denmark*, a third presented by the King of *France* to the Royal Academy; a fourth has been in *England*, where it was publicly exposed. The Effects whereof, as found by *Dr. Harris* and *Dr. Desaguliers*, are, that a Silver Six-pence is melted in 7" and $\frac{1}{2}$; a King George's Halfpenny in 16", and runs with a Hole in 34; Tin melts in 3", cast Iron in 16", Slate in 3", a Fossil-Shell calcines in 7", a Piece of *Pompey's* Pillar at *Alexandria*, vitrifies in the black Part in 50", in the white in 54, Copper Ore in 8": Bone calcines in 4", vitrifies in 33". An Emerald melts into a Substance like a Turquoise Stone; a Diamond weighing 4 Grains, loses $\frac{1}{2}$ of its Weight: The *Asbestos* vitrifies, as all other Bodies will do, if kept long enough in the Focus: But when once vitrified, the *Mirror* can go no further with them. This *Mirror* is 47 Inches wide, and is ground to a Sphere of 76 Inches Radius; so that its Focus is about 38 Inches from the Vertex.— Its Substance is a Composition of Tin, Copper, and Tin-Glass.

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Wolffius tells us, that an Artist of *Dresden* made *burning Mirrors* of Wood, bigger than those of *M. Tschirnhausen*, or *Villette*, which had Effects at least equal to any of them. *Traberus* teaches how to make *burning Mirrors* of Leaf-Gold, viz. by turning a Concave, laying its Inside equally with Pitch, and covering that with square Pieces of Gold, two or three Fingers broad, fastening them on, if need be, by Fire. He adds, that very large *Mirrors* may be made, of 30, 40, or more concave Pieces, artfully joined in a wooden Dish or Skuttle, the Effects of which will not be much less than if the Surface was continuous. *Zabnius* adds further, that *Newman*, an Engineer at *Vienna*, in 1699, made a *Mirror* of Palteboard, covered within Side with Straw glewed to it; by which all Kinds of Metal, &c. were readily melted.

From this same Principle is likewise deduced a Method of representing the Images of Objects in a dark Room.

2. A lucid Body being placed in the Focus of a concave *Mirror*, the Rays after Reflection become parallel.

Hence an intense Light may be projected to a vast Distance, by a lighted Candle, &c. placed in the Focus of a concave *Mirror*. Hence also, if the parallel Rays be received by another concave *Mirror*, they will again concur in its Focus and burn.

Zabnius mentions an Experiment of this Kind made at *Vienna*, where two concave *Mirrors*, the one six, the other three Foot Diameter, being placed about 24 Feet apart, with a live Coal in the Focus of the one, and a Match and Tinder in the other, the Rays of the Coal lighted the Candle.

3. If a lucid Body be placed between the Focus and *Mirror*, the Rays after Reflection will diverge from the Axis. Whence it follows that Light is weaken'd by Reflection.

4. If a lucid Body be placed between the Focus and the Center, the Rays after Reflection will meet in the Axis beyond the Center.

5. If a luminous Body be placed in the Center of the *Mirror*, all the Rays will be reflected back upon themselves.

Hence, if the Eye be placed in the Center of a concave *Mirror*, it will see nothing but itself, and that confused through the whole *Mirror*.

6. If a Ray falling from the Point of the Cathetus, on the convex *Mirror*, be together with its Reflex, continued within the Concavity of the *Mirror*; there will be a Ray of Incidence from the Point of the Cathetus, together with its Reflex.

Hence, if the Image of an Object reflected by a convex *Speculum*, be seen by a Reflection made in its Concavity, it will appear like the Object itself.

And since the Image of an infinite Cathetus, is less in a convex Glass by one Fourth of its Diameter; a Portion of the Cathetus less than a fourth Part of the Diameter, may appear of any Magnitude required in a concave one.

A Point therefore distant from a concave *Speculum*, less than one Fourth of the Diameter, must appear behind the *Mirror*, at any Distance, how great soever.

Since the Image of any Object, how broad soever, is contained in a convex *Speculum*, between the two Lines of Incidence of its extrem Points; if an Object be placed between the two Lines, at a Distance less than one Fourth of its Diameter, the Breadth of the Image, how great soever, may all appear.

Since then the Image of an Object included between two Lines, at a Distance less than one Fourth of the Diameter, may exceed the just Height and Breadth of the Object; nay, may be made of any Magnitude, how big soever, Objects placed between the Focus and the *Mirror*, must appear of enormous Magnitudes in concave *Mirrors*, as it is less in the Convex.

In a convex *Mirror*, the Image of a remote Object appears nearer the Center than that of a nearer Object: Therefore in a concave *Mirror*, the Image of an Object remote from the *Mirror*, appears at a greater Distance than that of a nearer Object, provided the Distance of the Object from the Center, be less than a

fourth Part of the Diameter.

In a convex *Speculum*, the Image of a remote Object is less than that of a near one; therefore in a concave one, the Image of an Object placed between the Focus and the *Mirror*, is nearer the Focus than the *Speculum*.

The Image therefore of an Object receding continually from a concave *Speculum*, becomes continually greater, provided it do not recede beyond the Focus where it becomes confected; and as it approaches it grows continually less.

In a convex *Speculum*, if the Sphere whereof it is a Segment be smaller, the Image is smaller than in another of a larger Sphere; therefore in a Concave, if the Sphere whereof it is a Segment be smaller, the Image will be larger than in another, whose Sphere is larger; whence concave *Mirrors*, if they be Segments of very small Spheres, will do the Office of Microscopes.

7. If an Object be placed between a concave *Mirror* and its Focus, its Image will appear behind the *Mirror*, in an erect, but inverted Situation.

8. If an Object be placed between the Focus and the Center, its Image will appear inverted, and in the open Air, beyond the Center, the Eye being placed beyond the Center.

9. If an Object be placed beyond the Center, and the Eye likewise beyond the Center, the Image will appear inverted in the open Air between the Center and the Focus.

Hence, the inverted Images of Objects placed beyond the Center are reflected by a concave *Mirror*, erect, and may be received on a Paper applied between the Center and the Focus, especially if the Room be dark: If the Object be further distant from the Center than the Focus, the Image will be less than the Object.

On this Principle concave *Mirrors*, especially those which are Segments of large Spheres, and are capable of reflecting entire Objects, exhibit many pleasing Phenomena. Thus, if a Man flourish a Sword against the *Mirror*, another comes out thereof, and meets him with the same Motions; and the Image of this Head coming out of the *Mirror*, if he strikes it with his real Sword, the imaginary Sword will strike his real Head. If he stretches out his Hand, another Hand will be stretched out of the *Mirror*, and meet it at a great Distance in the open Air, &c.

10. The Image of a Right-Line, perpendicular to a concave *Mirror*, is a Right-Line; but all oblique or parallel Lines are concave.

Cylindrical, conical, parabolical, and elliptical Mirrors, or *Specula*, are those terminated by a Surface, respectively *cylindrical, conical, parabolical, and spheroidical*.

Note, That to prepare or make *cylindrical, conical, &c. Mirrors*, the Process is as follows:—For the *cylindrical* and *conical* Sort, if they are to be of Glass, the Method of preparing them is the same as that already laid down for convex *Mirrors*. If of Metal they are to be made after the Manner of concave *Mirrors*, only that the Clay Moulds there described require other wooden ones of the Figure of the *Mirror*.—For *elliptical, parabolical, and hyperbolical Mirrors* the Mould is to be thus prepared: On a wooden or brazen Plane or Table, describe the Figure of an *Ellipse, Parabola, or an Hyperbola*; which done, cut out the Figure from the Plane, with all the Accuracy imaginable. To the elliptick Figure fit an Axis, with two Fulcra to sustain it, &c. and a Handle to move it. Lay a Quantity of the Clay above-described under it, and turn about the Axis with the Handle, till the Plane has turned or impressed the elliptical Figure thereon.—The Axis of the *parabolical, or hyperbolical* Figure, is to be fixed at the Vertex in such Manner as that it may always remain erect. This to be turned about as above, till it has given its own Figure to the Clay applied about it.—The Part of the Mould thus formed is to be dried, and either smeared over with Fat, or sprinkled with Brick-dust. Then a convex Mould to be made, by putting a Quantity of the same Clay into a Cavity thus formed. This latter is called the *Male*, as the former the *Female* Mould.—The *male* Mould being well dried, is to be applied

within the *Female*, in such Manner as only to leave the intended Thickness of the *Mirror* between them. The rest as for concave *Mirrors*.—These *Mirrors* are not made without the utmost Difficulty; by reason, be the Moulds ever so just, the Figure of the *Mirror* is apt to be damaged in the grinding.

As to the *Phænomena, and Properties* of *cylindrical Mirrors*.—1. The Dimensions of Objects corresponding Length-wise to the *Mirror*, are not much changed; but those corresponding Breadth-wise have their Figures altered, and their Dimensions lessened so much the more, as they are further from the *Mirror*. Whence arises a very great Distortion.

2. If the Plane of Reflection cuts the *cylindrical Mirror* through the Axis, the Reflection is performed in the same Manner as in a plain *Mirror*; if it cuts its Parallel to the Base, the Reflection happens in the same Manner as in a spherical *Mirror*; if, lastly, it cuts it obliquely, or be oblique to its Base, the Reflection is the same as in an elliptick *Mirror*.

Hence as the Plane of Reflection never passes through the Axis of the *Mirror*, except when the Eye and objective Line are in the same Plane, nor parallel to the Base, except when the radiant Point and the Eye are at the same Height: The Reflection in a *cylindrical Mirror* is usually the same as in an elliptick one.

3. If a hollow *cylindrical Mirror* be opposed directly to the Sun, instead of a Focus of a Point, the Rays will be reflected into a lucid Line parallel to its Axis, at a Distance somewhat less than a fourth Part of its Diameter.

Hence arises a Method of drawing *Anamorphoses*, i. e. wild deformed Figures on a Plane, which appear beautiful and well proportioned when viewed in a *cylindrical Mirror*.

We are not much acquainted with the Properties of *elliptick, conic, and pyramidal Mirrors*; only that in the first, if a Ray strike on it from one of its Focus's, it is reflected into the other: So that a lighted Candle being placed in one, its Light will be collected in the other.

That the second, inasmuch as all the Rays they reflect meet in one Point, make the best Burning-Glasses of all others.

And, lastly, that wild irregular Figures may be so drawn on a Plane, as that the Eye being placed over the Axis of the two last, they shall appear beautiful and well proportioned.

Besides the *catoptrick Machines* above-mentioned, and accurately described and explained, there is another called *reflecting, or catoptrick Telescope*, which instead of Lens, consists chiefly of *Mirrors*, and exhibits remote Objects by Reflection instead of Refraction.

This Instrument is the Invention of Sir Isaac Newton; what determined him to apply his Thought this Way, was the different Refrangibility, which, in his new Doctrine of Light and Colours he found the Rays of Light were of. In effect, as he found the Ratio between the greatest and least Refractions of the different Rays to be nearly as 28 to 27, it easily followed, that the Rays could never be all refracted parallel from any Lens, but would some of them divaricate more, some less; besides, that the Foci would be disturbed; the Focus of the most refrangible Rays being nearer the Lens than that of the least refrangible ones, by a Distance which is the 27th Part of the Distance between the Object-Glass, and the Focus of the least refrangible ones.

Hence he concluded, that Refraction was too unequal a Principle; and that Lens's of whatever Figures, whether spherical, parabolical, or any of the other conick Sections, and how truly soever ground, would never suffice for the Perfection of *Telescopes*.

Upon this he had Recourse to another more equal Principle, viz. Reflection, and made a Telescope consisting of *Specula, or Mirrors*: The first Hint whereof, he took from Dr. Gregory's *Opticks*.

Note, That for the Construction of this *reflecting Telescope*, a Tube A B C D, fig. 22. must be provided, open in A D, and closed in B C, well blacked within Side, and of a Length equal to the Distance of the Focus; from the concave *Speculum* E F, to the Bottom B C, is to be fitted a concave metallick *Speculum*, a b,

a b, polished to the greatest Perfection; or rather, to have the Objects clearer, and more distinct, let it be a Glass *Speculum*, concave on its fore Side, and equally convex on the hind Side; for unless it be of the same Thickness every where, it will reflect the Images of Objects tinged with a spurious Colour; and indistinct. Towards the other End of the Tube, is fixed an Iron Piece, to which is cemented a plain metallick *Speculum*; or, which is better, a triangular Prism of Glass or Crystal, whose upper Angle is a right Angle, the two others half right. The Faces or Planes that meet in the upper Angle to be square, and the third a Parallelogram. This Prism is to be disposed as that a Ray reflected from the *Speculum*, passing through the Middle of the Face *G M*, may cut it at right Angles; but be inclined to Rectangle *M N*, in an Angle of 45° . Its Distance from the concave *Speculum* *E F*, is to be such, as that the Rays *a c* and *b d*, reflected from the concave *Speculum*, may, after a second Reflection, from the Base of the Prism, concur in the Point *e*; that is, the Distance of the Focus *e*, from the reflecting Surface of the Prism, and the Distance of that from the concave *Speculum*, is to be equal to the Distance of the Focus from the concave *Speculum*. In *I* is placed a Plano-Convex Lens, whose Focus is in *e*, that the reflected Rays may enter the Eye parallel. Lastly, this Lens is covered with a thin Brass or Leaden Plate, having a little round Perforation therein, for the Eye to look through, by which Means all foreign Rays are excluded, which would otherwise occasion Confusion.

In the first Telescope of this Kind, which the Inventor made, the Semi-Diameter of the concave metallick *Speculum*, was $12\frac{2}{3}$ Digits, or Tenths of an Inch; from which, therefore, the Focus was $6\frac{1}{2}$ Digits distant. The Diameter of the Eye-Glass was $\frac{1}{8}$ of a Digit; so that it magnified the Diameter of the Object in the Ratio of 1 to 38; but he found that Objects were found somewhat obscure hereby; on which Account, he afterwards recommended Glass *Specula* instead of metallick ones; adding that there is nothing more required to the Perfection of this Telescope, but that the Art of polishing Glass be brought to greater Perfection; for that some Inequalities, which do not hurt Lens's, are found to affect *Specula*, and prevent Objects being seen distinctly.

The same Author observes, that if the Length of the Instrument be 6 Feet, and consequently the Semi-Diameter of the concave *Speculum* 12, the Aperture of the *Speculum* is to be 6 Inches; by which Means the Object will be increased in the Ratio of 1 to 200 or 300.

If it be longer or shorter, the Aperture must be as the Cube of the Quadrato Quadrate Root of the Length, and its magnifying Power as its Aperture. The *Speculum* he orders to be an Inch or two broader than the Aperture.

Note also, That having thus ended what regards the Doctrine of *Catoptricks*, I'll pass to that of *Dioptricks*; which is properly the third Branch of *Opticks*.

DIOPTRICKS (formed of *δια*, *per*, *through*, and *ωπλον*, *I see*) is the Doctrine of refracted Vision, called also *Anaclosticks*: Its Office being to consider and explain the Effects of Light refracted by passing through different Mediums, as Air, Water, Glass, &c. and especially Lenses.

To proceed with some Order on this curious Subject, I'll explain first the Laws of *Dioptricks*; and conclude by the Application thereof, in the Construction of *Telescopes*, *Microscopes*, and other *Dioptrical* Instruments.

The most essential of those Laws, are those of *Refraction*, which in *Dioptricks* is in the Inflection or Bending of the Rays of Light, in passing the Surfaces of Glasses, Lenses, and other transparent Bodies of different Densities.

The general Laws of *Refraction* are as follow: 1. *A Ray of Light in its Passage out of a rarer, into a denser Medium, e. gr. out of Air into Glass, is refracted towards the Perpendicular, i. e. towards the Axis of Refraction.*

Hence the refracted Angle is less than the Angle of

Inclination: And the Angle of Refraction less than that of Incidence.

Hence also a Ray perpendicular to the refracting Surface, will pass through without being refracted; as it cannot be refracted to the Perpendicular. The physical Cause thereof is, that the Attraction of the denser Medium, which in Incidences oblique to its Surface acting perpendicular to that Surface, draws the Ray out of its Course: This Attraction, we say, in a perpendicular Incidence, acts in the Direction of the Ray.

2. *The Ratio of the Sine of the Angle of Inclination, to the Sine of the refracted Angle, is fixed and constant, viz. if the Refraction be out of Air into Glass, it is found greater than as 114 to 76; but less than 115 to 76; that is, nearly as 3 to 2.*

This Ratio assigned by *Huygens*, agrees with another of *Sir Isaac Newton*, who makes the Sine of the Angle of Inclination, to the Sine of the refracted Angle, as 31 to 20; which is, likewise, nearly as 3 to 2. Indeed there is some Difference in the Quantity of Refraction, in different Kinds of Glass; but in physical Matters, Preciseness is not necessary. In Rain-Water, *Des Cartes* found, the Ratio of the Sine of the Angle of Inclination, to the Sine of the refracted Angle, as 250 to 187, that is, nearly as 4 to 3; which agrees with *Sir Isaac Newton's* Observation, who makes it as 529 to 396. In Spirit of Wine, the same great Author makes the Ratio as 100 to 73; which is not far from the sesquitertian Ratio. In Air he makes it as 3851 to 3850.

Whence the different refractive Power in different Fluids arises, is not determined. Clear Water, of all others, refracts the least; and if impregnated with Salts, its Refraction is increased in Proportion to the Quantity of Salt. *Sir Isaac Newton* shews, that in many Bodies, *e. gr.* Glass, Crystal, a Selenites, Pseudo-Topaz, &c. the refractive Power is proportionable to their Densities; only in sulphurous Bodies, as Camphire, Oil, Amber, Spirit of Turpentine, &c. the Power is two or three Times greater than in other Bodies of equal Density; yet they have the refractive Power with Respect to each other, nearly as their Densities. As to Air, he shews, that a Ray of Light in traversing quite thro' the Atmosphere, is refracted the same it would be, were it to pass with the same Obliquity out of a Vacuum into Air of equal Density with that in the lowest Part of the Atmosphere.

From the Laws just laid down, it follows, that one Angle of Inclination, and its corresponding refracted Angle being found by Observation; the refracted Angles corresponding to the several other Angles of Inclination, are easily computed. Now *Zabnius* and *Kircher* have found, that if the Angle of Inclination be 70° , the refracted Angle will be $38^\circ 50'$; on which Principle, *Zabnius* has constructed a Table of Refractions out of Air into Glass, for the several Degrees of the Angle of Inclination; a Specimen whereof follows:

| Angle of Inclination. | Refracted Angle. | Angle of Refraction. |
|-----------------------|-------------------|----------------------|
| 10 | $0^\circ 40' 5''$ | $0^\circ 19' 55''$ |
| 2 | 1 20 6 | 0 39 54 |
| 3 | 2 0 3 | 0 59 56 |
| 4 | 2 40 5 | 1 19 55 |
| 5 | 3 20 3 | 1 39 57 |

| Angle of Inclination. | Refracted Angle. | Angle of Refraction. |
|-----------------------|--------------------|----------------------|
| 10° | $6^\circ 39' 16''$ | $3^\circ 20' 44''$ |
| 20 | 13 11 35 | 6 48 25 |
| 30 | 19 29 29 | 10 30 31 |
| 45 | 28 9 19 | 16 50 41 |
| 90 | 41 51 40 | 48 8 20 |

Hence it appears, that if the Angle of Inclination be less than 2° , the Angle of Refraction out of Air into Glass, is almost $\frac{1}{3}$ of the Angle of Inclination: And therefore the Ray is refracted to the Axis of Refraction, by almost a third Part of the Quantity of its Angle of Inclination. And on this Principle it is, that *Kepler*, and most other dioptrical Writers, demonstrate the Refractions in Glasses.

The

The constant Ratio of the Sines of the Angles of Inclination, and the refracted Angles, was first discovered by *Snellius*, according to some *English* Authors, who are willing to rob *Des Cartes* of that Honour, though all *Europe* agree that he was the Inventor thereof.

Indeed as the Rays of Light are not of the same Degree of Refrangibility; this constant Ratio must be different in different Kinds. The Ratio therefore observ'd by Authors, is to be understood of Rays of the mean Refrangibility, *i. e.* of green Rays. The Difference of Refraction between the least and most refrangible Rays, that is, between violet and red Rays, Sir *Isaac Newton* shews it about $\frac{1}{20}$ Part of the whole Refraction of the mean refrangible, which Difference he owns so small, that there seldom needs any Regard had to it.

3. *When a Ray passes out of a denser into a rarer Medium, e. gr. out of Glass into Air, it is refracted from the perpendicular, or from the Axis of Refraction.* And hence the Angle of Refraction is greater than the Angle of Inclination.

Hence also, if the Angle of Inclination be less than 30° ; *MBC* is nearly equal to $\frac{1}{2}$ of *MBE*. Therefore *MBC*, is one Half of *CBE*; consequently if the Refraction be out of Glass into Air; and the Angle of Inclination be less than 30° ; the Ray is refracted from the Axis of Refraction, by almost one half Part of the Angle of Inclination. And this is the other *dioptrical* Principle, used by most Authors after *Kepler*, to demonstrate the Refractions of Glasses.

If the Refraction be out of Air into Glass, the Ratio of the Sine of Inclination, to the Sine of the refracted Angle, is as 2 to 3; if out of Air into Water, as 4 to 3: Therefore, if the Refraction be the contrary Way, *viz.* out of Glass or Water into Air; the Ratio of the Sines, in the former Case, will be as 2 to 3, in the latter as 4 to 3.

4. *A Line falling on a Curve Surface, whether concave or convex, is refracted after the same Manner, as it fell on a Plane, which is a Tangent to the Curve in the Point of Incidence.*

For the Curve and Plane Surface touching it, have an infinitely small Part common to them both; (each being originally generated by the Flux of a Point) but a Ray is refracted in such a little Part; therefore it is the same as if it was refracted in such a Plane.

5. *If a right Line cuts a refracting Surface at right Angles, and if from any Point in the denser Medium, be drawn a Parallel to the incident Ray, this will meet the refracted Ray, at the less Extreme of the Parallel; and will be to it as the Sine of the refracted Angle, to the Sine of the Angle of Inclination.*

Hence if *BC*, fig. 25. pass out of Glass into Air, it is in a subsequalterate Ratio, to *CD*; if out of Air into Glass, into a sesquialterate Ratio to *CD*.

Hence also, if Light pass out of Water into Air; *CB* is in a subsequitertian Ratio to *CD*; if out of Air into Water in a Sesquitertian.

The *Laws of Refraction in Plane Surfaces*, are, 1. If parallel Rays be refracted out of one transparent Medium into another of different Density, they will continue parallel after Refraction.

The physical Reason is, that being parallel, their Obliquity, or Angle of Incidence is the same: But at equal Obliquities we have shewn the Refraction is equal; consequently the Parallelism, which they had before the Refraction, will be retained after it.

But this may be also demonstrated geometrically, thus: If the Rays be perpendicular to the refracting Surface, they will pass without any Refraction; consequently being parallel before their Passage, they will be so after it. If they fall obliquely, the Angle of Incidence, and consequently also the Angle of Inclination, have the same Ratio to the Sines of the refracted Angles; therefore the refracted Angles are also equal; consequently the refracted Rays are parallel.

Hence a Glass, plain on both Sides, being turned directly to the Sun; the Line passing through, it will be propagated after the same Manner as if the Glass was away: For the Rays being perpendicular, will pass without Refraction. If the Glass be turn'd obliquely to the Sun, the Light after Refraction will be of the same In-

tensity as before; the Intensity depending on the Spissitude or Closeness of the Rays, and on the Angle wherein they strike the Object, or the Eye, both which are here unvaried.

2. If two Rays proceeding from the same Radiant, and falling on a Plane Surface of a different Density, so as the Points of Refraction are equally distant from the Cathetus of Incidence; the refracted Rays have the same virtual Focus, or Point of Dispersion.

Hence, 1. Since in Rays very near each other, the Distance of the Cathetus is the same as to Sense; very near Rays will diverge from the same Point, *i. e.* have the same virtual Focus.

And hence, 2. When refracted Rays falling on the Eye, placed out of the Cathetus of Incidence, are either equally distant from the Cathetus, or very near each other; they will flow upon the Eye, as if they came to it from the virtual Focus; consequently the Radiant will be seen by the refracted Rays as in the Focus.

3. If a Ray fall obliquely out of a thinner into a denser Medium, having a Plane Surface; the Distance of the radiant Point will have a less Ratio to the Point of Dispersion, or virtual Focus, than the Sine of the refracted Angle to the Sine of the Angle of Inclination. But if the Distance of the Point of Refraction from the Cathetus of Incidence, than the 11th or 19th Part of the Distance of the radiant Point; and if in the former Case the 10th, in the latter the 100th Part thereof be so small, that it cannot be assigned, or need not be minded; then will the Radiant be to the virtual Focus, as to Sense, in the Ratio of the Sine of the refracted Angle, to the Sine of the Angle of Inclination.

Hence, 1. If the Refraction be out of Air into Glass, the Distance of the Point of Dispersion of Rays near the Cathetus, is sesquialterate of the radiant Point; of more remote Rays, greater than sesquialterate.

Hence, 2. If the Eye be placed in a double Medium, Objects in a rarer, will appear more remote than they are; and the Place of the Image in any given Case, may be determined from the Ratio of the Refraction. Thus *to Fishes swimming under Water, Objects out of Water must appear further distant than in Reality they are.*

4. If a Ray fall obliquely out of a denser into a rarer Medium, the Distance of a radiant Point has a greater Ratio to the Distance of the Point of Dispersion, than the Sine of the refracted Angle, has to the Sine of the Angle of Inclination. In the other Case of the preceding Theorem, will be to the Point of Dispersion, as to Sense, in the Ratio of the Sine of refracted Angle, to the Sine of the Angle of Inclination.

Hence, 1. If the Refraction be out of Glass into Air, the Distance of the Point of Dispersion of Rays near the Cathetus of Incidence, is subsequalterate of the Distance of the radiant Point; that of the more remote Rays, is less than subsequalterate.

But, 2. If the Refraction be out of Water into Air, the Distance of the Point of Dispersion of Rays, near the Cathetus, is subsequitertian; of those more remote, less than subsequitertian.

And, 3. The Eye therefore being in a rarer Medium, Objects placed in a denser, appear nearer than they are; and the Place of the Image may be determined in any given Case by the Ratio of Refraction. Hence the Bottom of a Vessel full of Water, is raised by Refraction to a third Part of his Height, with Respect to an Eye perpendicularly over the refracting Surface; and hence *Fishes and other Bodies under Water, appear nearer than they really are.*

5. If the Eye be placed in a rarer Medium, an Object seen in a denser Medium, by a Ray refracted in a Plane Surface, will appear larger than it really is. If the Object be in a rarer, and the Eye in a denser Medium, the Object will appear less than it is. And in each Case the apparent Magnitude, is to the real one, in a Ratio compounded of the Distance of the Point, to which the Rays tend before Refraction, from the refracting Surface, to the Distance of the Eye, from the same, and of the Distance of the Object, from the Eye, to its Distance from a Point to which the Rays tend before Refraction.

Hence, 1. If the Object *AD*, be very remote, *FM*

will be physically equal to GM ; and therefore the real Magnitude MB , to its apparent one MH ; or the Distance of the Eye from the refracting Plane, to the Distance of the Point of Convergence from the same Plane.

Hence, 2. *Objects under Water, to an Eye in the Air, appear larger than they are; and to Fishes under Water, Objects in the Air appear less than they are.*

The *Laws of Refraction in spherical Surfaces, both concave and convex*, are, 1. A Ray of Light DE (fig. 19.) parallel to the Axis of a denser Sphere; after a single Refraction in E , falls in with the Axis in the Point f , beyond the Center C .

For the Semi-Diameter CE drawn to the Point of Refraction E , is perpendicular to the Surface, and is therefore the Axis of Refraction; and therefore the Ray DE will converge to the Axis of the Sphere AF ; and will, therefore, at length concur with it; and that beyond the Center C , in F , because the Angle of Refraction FEH , is less than the Angle of Inclination CEH .

2. If a Ray fall on a spherically convex Surface of a denser Medium, parallel to its Axis; the same Diameter will be to the refracted Ray, in the Ratio of the Sine of the refracted Angle, to the Sine of the Angle of Inclination: But the Distance of the Focus or Point of Concurrence, from the Center, is to the refracted Ray in the Ratio of the Sine of the refracted Angle, to the Sine of the Angle of Inclination.

3. If a Ray fall on a denser Spherical convex Surface parallel to the Axis; the Distance of the Focus from the refracting Surface, is to its Distance from the Center, in a Ratio greater than that of the Sine of the Angle of Inclination, to the Sine of the refracted Angle. But if the Ray be very near the Axis, and the Angle of Inclination only of a few Degrees; the Distances of the Focus from the Surface, and the Center, will be nearly in the Ratio of the Sine of the Angle of Inclination, to the Sine of the refracted Angle.

Hence, 1. If the Refraction be out of Air into Glass; in the Case of Rays near the Axis $BF : FC :: 3 : 2$. And in the Case of the Rays remote from the Axis, $BF : FC \nabla 3 : 2$. Consequently in the former Case, $BC : BF :: 1 : 3$; and in the latter $BC : CF \angle 1 : 3$.

And, 2. If the Refraction be out of Air into Water; in the former Case, $BF : FC :: 4 : 3$; and in the latter $BF : FC \nabla 4 : 3$. Consequently in the former Case $BC : BF :: 1 : 4$; and in the latter $BC : BF \angle 1 : 4$.

Hence, 3. Since the Sun's Rays are parallel as to Sense; if they fall on the Surface of a solid Glass Sphere, or of a Sphere full of Water, they will not concur with the Axis within the Sphere: So that *Vitelio* was mistaken when he imagined that the Sun's Rays falling in the Surface of a crystalline Sphere, refracted to the Center.

4. If a Ray parallel to the Axis fall out of a denser into a rarer spherical Medium, after Refraction it will diverge from the Axis; and the Distance of the Point of Dispersion, or the virtual Focus from the Center of the Sphere, will be to its Semi-diameter, in the Ratio of the Sine of the refracted Angle to the Angle of Refraction; but to the Portion of the refracted Ray drawn back, in the Ratio of the Sine of the refracted Angle, to the Sine of the Angle of Inclination.

5. If a Ray fall parallel to the Axis on the spherical convex Surface, of a rarer Medium out of a denser; the Distance of the Point of Dispersion from the Center, is to its Distance from the Surface, in a Ratio greater than that of the Sine of the refracted Angle to the Sine of the Angle of Inclination. But if the Rays be very near the Axis, the Ratio will be very nearly the same with that of the refracted Angle to the Sine of the Angle of Inclination.

Hence, 1. If the Refraction be out of Glass into Air; in the Case of Rays near the Axis, $FC : FB :: 3 : 2$. consequently $BC : FB :: 1 : 2$. Therefore in the Case of Rays more remote from the Axis $BC : FB \angle 1 : 2$.

2. If the Refraction be out of Water into Air; in the former Case $FC : FB :: 4 : 3$. Consequently $BC : FB :: 1 : 3$; in the latter Case therefore, $BC : FB \angle 1 : 3$.

3. Since then the Point of Dispersion is more remote from the refracting Surface, if the Rays proceed out of Water, then out of Glass into Air; parallel Rays are

less dispersed in the former Case than in the latter.

6. If a Ray HE (fig. 23.) fall parallel to the Axis FA , out of a rarer, on the Surface of a spherically concave denser Medium; the refracted Ray EN will be driven from the Point of the Axis F ; so as FE will be to FC , in the Ratio of the Sine of the Angle of Inclination, to the Sine of the refracted Angle.

7. If a Ray fall parallel to the Axis on the concave Surface of a spherical denser Medium, from a rarer; the Distance of the Point of Dispersion from the refracting Surface, is to its Distance from the Center, in a Ratio greater than that of the Sine of the Angle of Inclination, to the Sine of the refracted Angle, but if the Rays be very near the Axis, and the Angle very small, the refracting Surface will be to the Center, very nearly in the Ratio of the Sine of the Angle of Inclination, to the Sine of the refracted Angle.

Hence, 1. If the Refraction be out of Air into Glass; in the Case of Rays near the Axis, $FB : FC :: 3 : 2$; in the Case of Rays more remote from the Axis, $FB : FC \nabla 3 : 2$. Consequently in the former, $BC : FC :: 1 : 2$; And hence, in the latter $BC : FC \angle 1 : 2$.

Hence also, 2. If the Refraction be out of Air into Water; in the Case of the Rays near the Axis, $FB : FC :: 4 : 3$. In the Case of Rays more remote from the Axis $FB : FC \nabla 4 : 3$. Consequently in the first Case, $BC : FC :: 1 : 3$. And hence in the latter $BC : FC \nabla 1 : 3$.

And hence, 3. Since the Point of Dispersion, is farther from the Center, if the Refraction be in Water then in the Air; the Rays will be less dispersed in the latter Case than in the former.

8. If the Ray HE (fig. 22.) fall parallel to the Angle AF , from a denser, upon the Surface of a spherically concave rarer Medium; the refracted Ray will concur with the Axis AF , in the Point F ; so as the Distance of the Point of Concurrence from the Center, may be to the refracted Ray in the Ratio of the Sine of the refracted Angle, to the Sine of the Angle of Inclination.

Note, That from this accurate Examen of the Laws of Refraction in *Dioptricks*, in general, I'll pass to a more particular one, of those Laws with Respect to *Lens's, Telescopes, Microscopes, Prisms, &c.* beginning by the Definition of *Lens*, &c.

LENS, in *Dioptricks*, properly signifies a small, oblong Glass, of the Figure of a Lentil; but is extended to any *Optick* Glass, not very thick, which either collects the Rays of Light into a Point, in their Passage through it, or disperses them further apart, according to the Laws of Refraction.

Lens's have various Figures; that is, are terminated by various Surfaces, from which they acquire various Names. Some are plain on one Side, and convex on the other; others convex on both Sides; both which are ordinarily called *convex Lens's*; though when we speak accurately, the former are called *Plano-Concave*. Others again, are concave on both Sides; others are concave on one Side, and convex on the other; which are called *Convexo-Concave*, or *Concavo-Convex Lens's*, according as the one or other Surface is more curve, or a Portion of a less Sphere.

It is to be here observed, that in every *Lens* terminated in any of the afore-mentioned Manners, a right Line perpendicular to the two Surfaces, is called the Axis of the *Lens*. Which Axis, when both Surfaces are spherical, passes through both their Centers; but if one of them be plane, it falls perpendicularly upon that, and goes thro' the Center of the other.

A *Lens*, one of whose Surfaces is convex, and the other concave, is called a *Meniscus*; sometimes also *Lunula*.

In a *Meniscus*, if the Diameter of the Convexity be equal to that of the Concavity, or Ray falling parallel to the Axis, will continue parallel thereto after Refraction.

Such a *Meniscus*, therefore, will neither collect nor disperse the Rays; and is therefore of no Use in *Dioptricks*.

To find the Focus of a *Meniscus*, the Rule is, as the Difference of the Semi-diameters of the Convexity and Concavity, is to the Semi-diameter of the Convexity:

So is the Diameter of the Concavity, to the Distance from the Focus to the *Meniscus*. Hence, if the Semi-diameter of the Concavity be triple the Semi-diameter of the Convexity, the Distance of the Focus from the *Meniscus* will be equal to the Semi-diameter; and therefore the *Meniscus* will be equivalent to a Lens equally convex on either Side.

Again, if the Semi-diameter of the Concavity be double that of the Convexity, the Distance of the Focus will be equal to the Diameter; and therefore the *Meniscus* will be equivalent to a *plano-convex Lens*.

If the Semi-diameter of the Concavity be quintuple that of the Convexity, the *Meniscus* will be equivalent to a Sphere.

The Semi-diameter therefore of the Convexity being given, that of the Concavity required to remove the Focus to any given Distance from the *Meniscus* is easily found.

Note, That Lens's are distinguished, with regard to their Manner of Preparation, into *ground*, and *blown*.

Blown Lens's are little Globules of Glass, melted in the Flame of a Lamp or Taper. But the Figure of these is seldom exact; besides, that the Smoak of the Lamp cleaves to the Surface in melting; on both which Accounts they come short of the Clearness of those that are ground, or turned and polished in the Bathe, in little Copper Basons or Dishes. The Secret is now found of making these exquisitely small, so as some of them do not exceed in Diameter, the sixth Part of a Line, which are found to magnify Objects several Millions of Times.

Note, also, That as to the Manner of grinding Lens's, I have explained it in my Treatise of *Glass-Grinding*, under the Letter G.

Now as to the *Laws of Refraction*, with regard to Lens's, those of *convex Lens*, and the Effects depending thereon are as follow.—1. A Ray of Light near the Axis and parallel thereto (*Table Opticks*, fig. 25.) striking on the plain Surface of a *plano-convex Lens*, directly opposite to the luminous Body, after Refraction concurs with the Axis in the Point F, and if C be the Center of the Convexity, CF will be to FL, that is, from the Distance of the Center from the Point of Concourse, or Focus, will be to the Distance of the Center in the convex Surface, in the Ratio of the Refraction.

For the plain Surface being directly opposed to the luminous Body, the Ray EG is perpendicular to AB, and therefore will pass unrefracted to H: Thus it strikes on AHB, still parallel to the Axis; and therefore coming out of a denser Medium into a rarer, will meet with the Axis of the Lens in b; and so as that CF will be to FL, in the Ratio of the Sine of the refracted Angle to the Sine of the Angle of Inclination, as demonstrated when I have explained *Refraction*.

Then the Refraction be out of a Glass Lens into Air $CF:EL::3:2$, and therefore $FL=2CL$, that is parallel Rays, near the Axis, will concur with it at the Distance of the Diameter.—Again, if the Refraction were out of a Water Lens, *i. e.* out of a *plano-convex Lens* filled with Water, $CF:EL::4:3$, and therefore $FL=3CL$, *i. e.* parallel Rays nearer the Axis, will concur with it at the Distance of half the Diameter. So that if a lighted Candle be placed in the Focus of a *plano-convex Lens*, that is, in the Point f, distant from the Surface of the Lens ALB, by the Length of the Diameter; and from the Surface of the Water Lens, by half the Diameter, its Rays, after Refraction, will become parallel.

2. If the Ray KL (fig. 24.) near the Axis of a *plano-convex Lens*, and parallel thereto, strikes on its convex Surface AOB, after a double Refraction, it will meet the Axis in F; so as that HG will be to GC, and GF to FH, in the Ratio of the Refraction.

For the Ray KI, parallel to the Axis EG, by virtue of the first Refraction in I, will tend to the Point G, so as GI will be to GC in the Ratio of the Sine of the Angle of Inclination to the Sine of the refracted Angles: Therefore by virtue of the second Refraction in L, it will concur with the Axis in F; so as GD will be to

FD, in the Ratio of the Sine of the refracted Angle, to the Sine of the Angle of Inclination.

So that the Semi-diameter and Thickness of the *plano-convex Lens*, with the Ratio of the Refraction being given, hence arises a Method of determining the Focus of parallel Rays, striking on the convex Surface. For,

Hence, if the Lens be Glass, $FD=2CH=\frac{2}{3}HD$, so that if two Thirds of the Thickness of the Lens be inconsiderable (as in Practice it usually happens) parallel Rays meet with the Axis at the Distance of the Diameter from the Lens, even when they strike on the convex Surface.

So that as to the Place of the Focus, it is the same Thing whether the plane Surface, or the convex one, be turned to a Luminary of parallel Rays; though it appears, both from Experience and trigonometrical Calculations, that there are more Rays united in a less Space, if the convex Surface, than if the plain one be turned towards the Sun.

If the Lens were full of Water $FD=3CH=\frac{3}{4}HD$; wherefore if $\frac{3}{4}HD$ be inconsiderable, $FD=3CH$, or if $\frac{1}{4}HD$ be inconsiderable, $FH=3CH$, parallel and near the Rays, therefore are united at the Distance of half the Diameter, if the Refraction be in Water, even when the convex Surface is opposed to the luminous Body. Hence also arises a Method of determining the Focus of parallel Rays striking on a Lens convex on both Sides, the two Semi-diameters, and the Thickness of the Lens being given.

On this Principle is founded the Structure of refracting Burning-Glasses, the Sun's Light and Heat being exceedingly augmented in the Focus of a Lens, whether convex or plano-convex, since the Rays falling parallel to the Axis of the Lens, are reduced into a much narrower Compass; so that it is no wonder they burn some Bodies, melt others, and produce other extraordinary Phænomena.

3. If a luminous Body be placed in a Focus behind a Lens, whether plano-convex, or convex on both Sides, or, whether equally or unequally, the Rays after Refraction become parallel.

Hence, by means of a convex Lens, or a little Glass Bubble full of Water, a very intense Light may be projected to a vast Distance.

And this furnishes us with the Structure of a Lamp, or Lanthorn, to project an intense Light to an immense Distance: For a Lens convex on both Sides being placed opposite to a concave Mirrour, if in the common Focus of both be placed a lighted Candle, or Wick, the Rays reflected back from the Mirrour to the Lens will be parallel to each other; and after Refraction will converge, till they concur to the Distance of the Semi-diameter, after which they will again diverge.—But the Candle being likewise in the Focus of the Lens, the Rays it throws on the Lens will be parallel: And therefore if a very intense Light meet with another equally intense at the Distance of the Diameter from the Lens, the Light will be surprising: And though it afterwards decrease, yet the parallel and diverging Rays going a long Way together, it will be very great at a very great Distance.—Lanthorns of this Kind are of considerable Service in the Night-time, to discover remote Objects, and are used with Success, by Fowlers and Fishermen, to gather their Prey together in order to take them.

If it be required to have the Light, at the same Time, transmitted through several Places, as through several Streets, &c. the Number of Lens's and Mirrours is to be increased.

If the luminous Body placed in the Focus, be of a larger Extent, the Rays flowing from Points sensibly distant from each other cannot be parallel; but will constitute several Trains or Parcel of Rays parallel to each other.

3. The Images of Objects, opposed in any Manner to a convex Lens, are exhibited invertedly in its Focus.

Hence, if a Paper be applied to a convex Lens (especially in a dark Room) at the Distance of its Focus, the Images of Objects shining upon it, will be represented distinctly, and in their natural Colours thereon: Nor is the Focus of the Sun's Rays any Thing else in effect, but the Image of the Sun. Hence in later

Eclipses

Eclipses the Sun's Image, eclipsed as it is, may be burnt by a large Lens on a Board, &c. a very entertaining Phenomenon.

Hence also, if a convex Lens of any Kind be exposed both to nearer and remoter Objects, and a Paper at the same Time be applied, so as to receive the Images of Objects distinctly, the Distance of the Focus from the Lens, and thence the Diameter of the Convexity may be determined.

4. If a concave *Mirrou* be so placed, as that an inverted Image, formed by Refraction through a Lens, be found between the Center and the Focus, or even beyond the Center, it will again be inverted by Reflection, and so appear erect in the first Case beyond the Center; and in the latter, between the Center and the Focus. On these Principles is built the *Camera obscura*.

Note, That *Camera obscura*, is a Machine or Apparatus, representing an artificial Eye; whereon the Images of external Objects, received through a double convex Glass, are exhibited distinctly, and in their native Colours, on a white Matter placed within the Machine, in the Focus of the Glass. The Use of the *Camera obscura* is manifold; it serves to very good Purposes in explaining the Nature of Vision; and hence it is that some call it the artificial Eye. It affords very diverting Spectacles; both by exhibiting Images perfectly like their Objects, and each cloathed with their native Colours; and by expressing, at the same Time, all their Motions: Which latter, no other Art can imitate. By Means of this Instrument, especially the third Contrivance under mentioned, a Person unacquainted with designing, will be able to delineate Objects to the last Accuracy and Justness; and another well versed in Painting, will find many Things herein to perfect his Art.

5. The Diameter of the Image of an Object, delineated beyond a convex Lens, is to the Object itself in the Ratio of the Distance of the Image to that of the Object.

Since then the Image of a remoter Object is less distant from the Lens than that of the nearer, the Image of the more remote, will be less than that of the nearer. And because the Distance of the Image from the Lens is greater, if the Lens be a Segment of a greater Sphere than of a less; hence the Image will be greater in the former Case than in the latter. The Image therefore will be of such a Magnitude, as it would be of, were the Object to shine into a dark Room, through a little Hole upon a Wall, at the same Distance from the Hole, at which the Focus is from the Lens. When an Object is less distant from a Lens than the Focus of parallel Rays, the Distance of the Image is greater than that of the Object; otherwise the Distance of the Image is less than that of the Object; in the former Case, therefore, the Image is greater than the Object, in the latter, less.

If the Images be made greater than the Objects, they will not appear distinctly; because in that Case there are fewer Rays which meet after Refraction in the same Point; whence it happens, that Rays proceeding from different Points of an Object, terminate in the same Point of an Image, which is the Cause of Confusion. Hence it appears, that the same Aperture of a Lens may not be admitted in every Case, if we would keep off the Rays which produce Confusion. However, though the Image is then more distinct, when no Rays are admitted but those near the Axis, yet for Want of Rays, the Image is apt to be dim.

6. If the Eye be placed in the Focus of a convex Lens, an Object viewed through it appears erect, and enlarged in the Ratio of the Distance of the Object from the Eye, to that of the Eye from the Lens, if it be near; but infinitely, if remote.

The Laws of concave Lens are as follows. 1. If parallel Rays strike on a Plano-Concave Lens K L, fig. 7. and F C be to F B in the Ratio of Refraction, the Rays will diverge from the Axis, and the Point of Divergency, or Dispersion, called the virtual Focus, will be F.

For the Ray H I, parallel to the Axis, is perpendicular to K L, and will therefore pass unrefracted to E. Wherefore F C being to F B in the Ratio of Refraction, F will be the virtual Focus.

If then, the Lens be Glass, $F B = 2 B C$, *i. e.* the

virtual Focus F will be distant from the Lens K L, by the Space of the Diameter 2 B C.

If the Refraction be in Water, $F B = 3 B C$, *i. e.* the virtual Focus F, will be distant from the Lens K L, a Diameter and a half 3 B C.

2. If the Ray A E, parallel to the Axis F P, strike on a Lens concave on both Sides; and both F C be to F B, and I P to P H, in the Ratio of Refraction; and $F P : P H :: F B : B G$; G will be the Point of Dispersion, or the virtual Focus, fig. 5.

If therefore the Refraction be in a Glass Lens, the Sums of the Semi-Diameters C B and H I, will be to the Diameter of the Concavity of either 2 H I, as the Semi-Diameter of the other C B, to the Distance of the virtual Focus, from the Lens B G.

Hence the Sun's Rays striking on a concave Lens, their Light after Refraction will be considerably weaken'd; so that the Effect of concave Lens is opposite to that of convex ones.

3. An Object viewed through a concave Lens, appears erect, and diminished in a Ratio compounded of the Ratio's of the Space in the Axis, between the Point of Incidence, and the Point to which an oblique Ray would pass without Refraction, to the Space in the Axis, between the Eye and the Middle of the Object; and the Space in the same Axis, between the Eye and the Point of Incidence, to the Space between the Middle of the Object, and the Point the oblique Ray would pass to without Refraction.

Though the Properties of Lens have been here considered principally with Regard to Rays falling near the Axis, and parallel thereto; yet the Reasoning will be easily transferred to Rays remoter from the Axis, and falling in any Direction. Thus we may say universally, that in a convex Lens, all parallel Rays become converging, and concur in a Focus; that diverging Rays either become less diverging, or run parallel, or converge; and that converging Rays converge the more: All which Alterations are more sensible in oblique Rays, than in perpendicular ones, by Reason the Angles of Incidence in that Case are greater.

In concave Lens, all parallel Rays become diverging, diverging Rays diverge the more; converging Rays, either converge less, or become parallel, or go out diverging: All which Things hold of oblique, as well as direct Rays, but more sensible in the first.

Note, That *Focus* (so often repeated throughout the Course of this Treatise) is, in *Opticks*, a Point wherein several Rays concur, and are collected; either after having undergone Refraction or Reflection. It is thus called, by Reason the Rays being here brought together, and united; their Force and Effect is increased; so that they become able to burn: Accordingly, it is in this Point, that Bodies are placed to sustain the Force of Burning-Glasses, or Mirrours. It must be observed, that *Focus* is not strictly a Point; the Rays are not all accurately collected in the same Place: *Huygens* demonstrates, that the *Focus* of a Lens convex on both Sides, is $\frac{1}{2}$ of the Thickness of the Lens. In *Dioptricks*, *Focus* is the Point wherein refracted Rays, render'd convergent by Refraction, do concur or meet, and cross the Axis. The same Point is also called the *Point of Concourse*, or *Concurrence*. And in *Catoptricks* *Focus*, is a Point wherein the Rays reflected from the Surface of a Mirrou or Speculum, and by Reflection render'd convergent, do concur, or meet.

Note also, That the Laws of the *Foci* of Glasses, and the Method of finding the same, being those of most Use and Importance; we shall here subjoin them apart, as deliver'd and demonstrated by M. *Molineaux*, in his *Dioptrica Nova*.

1. Then the Focus of a convex Glass, *i. e.* the Point wherein parallel Rays transmitted through a convex Glass, whose Surface is the Segment of a Sphere, do unite, is distant from the Pole or Vertex of the Glass, almost a Diameter and a half of the Convexity.

2. In a Plano-Convex Glass, the Focus of parallel Rays, or the Place where they unite with the Axis, is distant from the Pole of the Glass, a Diameter of the Convexity; provided the Segment do not exceed thirty

thirty Degrees. The Rule, or Canon in Plano-Convex Glafs, is as 107 : 193 :: fo is the Radius of the Convexity, to the refracted Ray, taken in its Courfe with the Axis; which in Glaffes of larger Spheres, is almost equal to the Distance of the Focus taken in the Axis.

3. In double convex Glaffes of the same Sphere, the Focus is distant from the Pole of the Glafs about the Radius of the Convexity, if the Segment be but thirty Degrees. But if the Convexity be unequal, or if the two Sides be Segments of different Spheres, then the Rule is, — as the Sum of the Radii of both Convexities : to the Radius of either Convexity alone : : fo is the double Radius of the other Convexity : to the Distance of the Focus. Here observe, that the Rays which fall nearer the Axis of any Glafs, are not united with it fo foon as those further off : Nor will the focal Distance be fo great, in a Plano-Convex Glafs, when the convex Side is towards the Object. Hence it is easily concluded, that in viewing any Object in a Plano-Convex Glafs, the convex Side should be turned outward; as also in burning by such a Glafs.

For the *virtual Focus*, observe, 1. That in concave Glaffes, when a Ray falls from Air parallel to the Axis, the *virtual Focus*, by its first Refraction, becomes at the Distance of a Diameter and a half of the Concavity.

2. In Plano-Concave Glaffes, when the Rays fall parallel to the Axis, the virtual Focus is distant from the Glafs, the Diameter of the Concavity.

3. In Plano-Concave Glaffes, as 107 : 193 :: fo is the Radius of the Concavity to the Distance of the virtual Focus.

4. In double Concaves of the same Sphere, the virtual Focus of parallel Rays, is as the Distance of the Radius of the Concavity. But whether the Concavities be equal or unequal, the virtual Focus, or Point of Divergency of the parallel Rays, is determined by this Rule. As the Sum of the Radii of both Concavities, is to the Radius of either Concavity : : fo is the double Radius of the other Concavity : to the Distance of the virtual Focus.

5. In concave Glaffes, if the Point to which the incident Rays converge, be distant from the Glafs farther than the virtual Focus of parallel Rays, the Rule for finding the virtual Focus of this Ray is this: As the Difference between the Distance of this Point from the Glafs, and to the Distance of the virtual Focus, fo is the Distance of this Point of Convergence from the Glafs, to the Distance of the virtual Focus of this converging Ray.

6. In concave Glaffes, if the Point to which the incident Rays converge, be nearer the Glafs, than the virtual Focus of parallel Rays, the Rule to find where it crosses the Axis is this: As the Excess of the virtual Focus, more than this Point of Convergence, is to the virtual Focus; fo the Distance of this Point of Convergence from the Glafs, is to the Distance of the Point where this Ray crosses the Axis.

The Rules for finding the *Foci* of Glaffes, are these: To find the Focus of a convex spherical Glafs, being of a small Sphere, apply it to the End of a Scale of Inches, and decimal Parts, and expose it before the Sun; upon the Scale you will have the bright Interfection of the Rays measured out; or expose it in the Hole of a dark Chamber; and where a white Paper receives the distinct Representation of distinct Objects, there is the Focus of the Glafs. For a Glafs of a pretty long Focus, observe some distant Object thro' it, and recede from the Glafs, till the Eye perceives all in Confusion, or the Object begins to appear inverted; here the Eye is in the Focus. For a Plano-Convex Glafs, make it reflect the Sun against the Wall, you will on the Wall perceive two Sorts of Light; one more bright within, another more obscure: Withdraw the Glafs from the Wall, till the bright Image is at its smallest; the Glafs is then distant from the Wall about the fourth Part of its focal Length. For a double Convex; expose each Side to the Sun in like Manner; and observe both the Distances from the Wall. The first Distance is about half the Radius of the

Convexity turned from the Sun; and the second, about half the Radius of the other Convexity. Thus we have the Radii of two Convexities; whence the Focus is found by this Rule: As the Sum of the Radii of both Convexities : is to the Radius of either Convexity : : fo is the double Radius of the other Convexity : to the Distance of the Focus.

Note also, That the next Thing we have to do, is to apply all the Rules above given to Practice, in the making of *Telescopes*, *Microscopes*, *Prisms*, *Spectacles*, &c. and giving the necessary Instructions for the Use thereof; and previously to all, the Definition of each in particular, beginning by the *Telescope*.

A TELESCOPE, is an optical Instrument, consisting of several Glaffes, or Lens fitted into a Tube, thro' which remote Objects are seen, as if nigh at Hand.

In *Telescopes*, the Lens or Glafs turned towards the Object, is called the *Object-Glafs*; and that next the Eye, the *Eye-Glafs*; and if the *Telescope* consists of more than two Lens's, all, but that next the Object, are called *Eye-Glaffes*.

Note, That to prove the Regularity and Goodness of an *Object-Glafs*, we must strike two concentrick Lines on a Paper, the one having its Diameter the same with the Breadth of the *Object-Glafs*; the other half the Diameter; and divide the inner Circumference into six equal Parts, make six fine small Holes therein with a Needle, and cover one Side of the Glafs with this Paper; then exposing it to the Sun, receive the Rays that pass through these six Holes, on a Plane, at a just Distance from the Glafs; and by withdrawing, or approaching this Plane, from or to the Glafs; we shall find whether the Rays that pass through these six Holes, unite exactly together at any Distance from the Glafs; if they do, we may be assured of the Regularity of the Glafs; that is, of its just Form; and at the same Time we obtain exactly the Glafs's focal Length. Indeed there is scarce any better Way to prove the Excellency of an *Object-Glafs*, then by placing it in a Tube, and trying it with small *Eye-Glaffes*, at several distant Objects; for that *Object-Glafs* which represents Objects the brightest, and most distinct, which bears the greatest Aperture, and most convex, and concave *Eye-Glafs*, without Colouring or Haziness, is the best. To prove whether *Object-Glaffes* be well center'd, we hold the Glafs at a due Distance from the Eye; and observe the two reflected Images of a Candle; where those Images unite or coalesce, there is the true Center; if this be in the Middle or central Point of the Glafs, it is truly center'd.

Telescopes are of several Kinds distinguished by the Number and Form of their Lens's or Glaffes; and denominated from their particular Uses; such are the *Terrestrial* or *Land Telescope*; the *Celestial* or *Astronomical Telescope*; to which may be added, the *Galilean* or *Dutch Telescope*, the *reflecting Telescope*, and the *aerial Telescope*.

The *Galilean* or *Dutch Telescope*, is a *Telescope*, consisting of a convex *Object-Glafs*, and a concave *Eye-Glafs*.

This of all others, is the most antient Form, being the only Kind made by the Inventors *Galileo*, &c. or known, before *Huygens*; whence its Name. Its Construction, Perfections, Imperfections, &c. are delivered in what follows:

For the Construction of a *Dutch Telescope*; in a Tube prepared for the Purpose, at one End is fitted a convex Object Lens, either a plain Convex, or convex on both Sides, but a Segment of a very large Sphere: At the other End is fitted an *Eye-Glafs*, concave on both Sides, and the Segment of a less Sphere; so disposed, as to be the Distance of the virtual Focus, before the Image of the convex Lens.

Note, That in the Construction of a *draw Tube* for a *Telescope*; the chief Points to be regarded are, that the *Tube* be not troublesome by its Weight, nor liable to warp and disturb the Position of the Glafs; so that any Kind of *Tube* will not serve in every Case.

But, — 1. If the *Tube* be small, 'tis best made of thin Brass Plates covered with Tin, and formed into Pipes or Drains, to slide within one another. — 2. For long *Tubes*, Iron would be too heavy; for which Reason some chuse to make them of Paper, thus: A wooden Cylinder is turned, of the Length of the Paper to be used; and of a Diameter equal to that of the smallest Draw; about this Cylinder is rolled Paper, till it be of a sufficient Thickness: When one Pipe is dry, provide others after the same Manner; still making the last serve for a Mould for the next, till you have enough for the Length of the *Tube* desired. Lastly, to the Extremes of the Draws are to be glewed wooden Ferrils, that they may be drawn forth the better. — 3. Since Paper-Draws are apt to swell in moist Weather, so as to spoil their sliding; and in dry Weather to shrink, which renders them loose and tottering: In both which Cases, the Situation of the Lens's is easily disturbed; the best Method of making *Tubes* is as follows:

Glue Parchment round a wooden Cylinder, and let the Parchment be coloured black, to prevent the reflected Rays making any Confusion; provide very thin Slits of Beech, and bending them into a Cylinder, glue them carefully to the Parchment: Cover this wooden Case with white Parchment, and about its outer Extreme make a little Ring or Ferril: After the same Manner make another Draw over the former; and then another, till you have enough for the Length of the *Tube*. — To the inner Extreme of each Draw, fit a wooden Ferril, that the spurious Rays striking against the Sides, may be intercepted and lost: In those Places where the Lens's are to be put, it will be proper to furnish the Ferrils with female Screws. Provide a wooden Cover to defend the object Glass from the Dust, and putting the Eye Glass in its wooden Ferril, fasten it by the Screw to the *Tube*. Lastly, provide a little wooden *Tube* of a Length equal to the Distance the Eye-Glass is to be from the Eye; and fit it to the other Extreme of the *Tube*.

Now in an Instrument, thus framed, all People, except *Myopes*, or those short-sighted, must see Objects distinctly in an erect Situation, and increased in the Ratio of the Distance of the virtual Focus of the Eye-Glass, to the Distance of the Focus of the Object-Glass.

But for *Myopes* to see Objects distinctly through such an Instrument, the Eye-Glass must be set nearer the Object-Glass. The Reason of these Effects will appear from what follows: For,

1. Since it is far distant Objects that are to be viewed with a *Telescope*, the Rays proceeding from the same Point of the Object, will fall on the Object-Glass parallel, and consequently by their Refraction through the Convexity, will be thrown converging on the Eye-Glass; but by their Refraction through the Concavity hereof, they will be again rendered parallel, and in such Disposition will enter the Eye. — But all, excepting *Myopes*, see Objects distinctly by parallel Rays.

2. Suppose A (fig. 30.) to be the Focus of the Object-Glass; and suppose A C, the farthest Rays on the right Hand of the Object that passes through the Tube: After Refraction it will become Parallel to the Axis B I, and consequently after a second Refraction through the concave Lens, will diverge from the virtual Focus. Wherefore since all the Rays coming from the same Extreme, to the Eye placed behind the concave Lens, are parallel to L E; and those from the Middle of the Object parallel to F G; the middle Point of the Object will be seen in the Axis G A; and the right Extreme, on the right Side, viz. in the Line L N, a Parallel thereto; that is, the Object will be erect: Which is the second Point.

3. Since all Right-Lines, parallel to L N, cut the Axis under the same Angle, the Semi-diameter of the Object will be seen through the *Telescope*, under the Angle A F N, or E F I: The Rays L E, and G I, entering the Eye in the same Manner, as if the Pupil was placed in F. If now the naked Eye were in A, it would see the Semi-diameter of the Object under the Angle C A B or C A B. But since the Object is supposed very remote, the Distance A F, in respect hereto is no-

thing, and therefore the naked Eye, even in F, would see the Semi-diameter of the Object under an Angle equal to A.

The Semi-diameter of the Object therefore, seen with the naked Eye, is to that seen through the *Telescope*, as I M to I E. But it is demonstrated, that I M : I E : I F : R B; that is, the Semi-diameter seen with the naked Eye, is to that viewed through the *Telescope*, in the Ratio of the Distance of the virtual Focus of the Eye-Glass F I, to the Distance of the Focus of the Object-Glass A B; which was the third Point.

Lastly, *Myopes* have their Retina too far from the crystalline Humour; and diverging Rays concur at a greater Distance than parallel ones; and those that were parallel become diverging, by bringing the Eye-Glass nearer the Object-Glass; by means of such Approach, *Myopes* will see Objects distinctly through a *Telescope*; which is the fourth Point.

Hence, 1. To have the whole Object visible, the Semi-diameter of the Pupil must not be less than the Distance of the Rays L E and G I; and therefore the more the Pupil is dilated, the greater Field or Compass will be taken in by the *Telescope*, and *vice versa*; so that coming out of a dark Place, or shutting the Eye for some Time before you apply it to the Glass, you will take in a greater Field at first Glance than afterwards, when the Pupil is again contracted by the Increase of Light.

2. Since the Distance of the Rays E L and I G, is greater at a greater Distance from the Lens, the Compass taken in by the Eye at one View, will be greater as the Eye is nearer the concave Lens.

3. Since the Focus of a plano-convex Object Lens, and the virtual Focus of a plano-concave Eye lens, is at the Distance of the Diameter; and the Focus of an Object Glass convex on both Sides, and the virtual Focus of an Eye-Glass concave on both Sides, is at the Distance of a Semi-diameter; if the Object-Glass be plano-convex, and the Eye-Glass plano-concave, the *Telescope* will increase the Diameter of the Object in the Ratio of the Diameter of the Concavity to that of the Convexity; if the Object-Glass be plano-convex, and the Eye-Glass concave on both Sides, the Semi-diameter of the Object will be increased in the Ratio of the Diameter of the Convexity to the Semi-diameter of the Concavity. And lastly, if the Object-Glass be convex on both Sides, and the Eye-Glass plano-concave, the Increase will be in the Ratio of the Diameter of the Concavity, to the Semi-diameter of the Convexity.

4. Since the Ratio of the Semi-diameter is the same as that of the Diameters, *Telescopes* magnify the Object in the same Manner, whether the Object-Glass be plano-convex, and the Eye-Glass plano-concave; or whether the one be convex on both Sides, and the other concave on both.

5. Since the Semi-diameter of the Concavity has a less Ratio to the Diameter of the Convexity than its Diameter has, a *Telescope* magnifies more if the Object-Glass be plano-convex, than if it be convex on both Sides.

6. The greater the Diameter of the Object-Glass, and the less that of the Eye-Glass, the less Ratio has the Diameter of the Object viewed with the naked Eye, to its Semi-diameter viewed with a *Telescope*; and consequently the more is the Object magnified by the *Telescopes*.

7. Since the Semi-diameter of the Object is increased in the Ratio of the Angle E F I, and the greater the Angle E F I is, the less Part of the Object does it take in at one View; the *Telescope* exhibits so much a less Part of the Object, as it increases its Diameter more.

And this is the Reason that determined the Mathematicians to look out for another *Telescope*, after having clearly found the Imperfection of the first, discovered by Chance; nor were their Endeavours vain, as appears from the *Astronomical Telescope*, hereafter to be described.

If the Semi-diameter of the Eye-Glass have too small a Ratio to that of the Object-Glass, an Object through the *Telescope* will not appear sufficiently clear, by reason the great Divergency of the Rays will occasion the several Pencils, representing the several Points of the Object on the Retina, to consist of too few Rays. This too is found, that equal Object-Lens's will not bear the same Eye-Lens's, if they be differently transparent, or there

be a Difference in their Polish: A less transparent Object-Glass, or one less accurately ground, requires a more spherical Eye-Glass, than another more transparent, &c.

Hence, though it be found by Experience, that a *Telescope* is good, if the Distance of the Focus of the Object-Glass be six Inches, and the Diameter of the Plano-Concave Eye-Glass be one Inch and one Line, or of one equally concave on both Sides one Inch and a half; yet it is by no Means expedient, to recommend to the weaker, either this, or any particular Combination, but to try several Eye Glasses, both greater and smaller, with the same Object-Glass, and try that through which Objects appear most clear and distinct.

Hewelius recommends an Object-Glass, convex on both Sides, whose Diameter is four *Dantzick* Feet; and an Eye-Glass concave on both Sides, whose Diameter is $4\frac{1}{2}$ Digits, or Tenths of a Foot. An Object-Glass, equally convex on both Sides, whose Diameter is five Feet, he observes, will require an Eye-Glass of $5\frac{1}{2}$ Digits; and adds, that the same Eye-Glass will also serve an Object-Glass of eight or ten Feet.

Hence, as the Distance of the Object-Glass and the Eye-Glass, is the Difference between the Distance of the virtual Focus of the Eye-Glass, and the Distance of the Focus of the Object-Glass; the Length of the *Telescope* is had by subtracting that from this; that is, the Length of the *Telescope* is the Difference between the Diameter of the Object-Glass and Eye-Glass, if that be convex on both Sides, and this concave on both; or the Difference between the Semi Diameter of the Object-Glass, and the Diameter of the Eye-Glass, if that be convex on both Sides, and this plano-concave; or the Difference between the Diameter of the Object-Glass, and the Semi-Diameter of the Eye-Glass, if that be plano-convex, and this concave on both Sides.

Thus, *e. gr.* if the Diameter of an Object-Glass on both Sides, be four Feet, and that of an Eye-Glass concave on both Sides, be four and a half Digits, or Tenths of a Foot; the Length of the *Telescope* will be one Foot eight Digits. Thus much of a *Dutch Telescope*.

An *Astronomical Telescope*, is a *Telescope* consisting of an Object-Glass and an Eye-Glass, both convex. It has its Name from its being wholly used in astronomical Observations.

For the Construction of an *Astronomical Telescope*. The Tube being prepared, an Object-Glass, either plano-convex, or convex on both Sides, but to be a Segment of a large Sphere, is fitted in at one End; at the other End, an Eye-Glass, convex on both Sides, which is the Segment of a small Sphere, is fitted at the common Distance of the Foci.

The Theory of this *Telescope* is as follows. An Eye placed near the Focus of the Eye-Glass, will see Objects distinctly, but inverted and magnified in the Ratio of the Distance of the Focus of the Eye-Glass, to the Distance of the Focus of the Object-Glass.

For, 1. Since it is very remote Objects are viewed through *Telescopes*, the Rays from one Point of the Object fall parallel on the Object-Glass; and consequently after Refraction, will meet in a Point behind the Glass, which Point is the Focus of the Eye-Glass. From this Point they begin to diverge, and fall diverging on the Eye-Glass, where, being refracted, they enter the Eye parallel.

Hence, as all but *Myopes*, see distinctly by parallel Rays, a *Telescope* thus disposed, will exhibit remote Objects distinctly.

Suppose the common Focus of the Lens's in F, fig. 32. and make $AB = BF$. Since one of the Rays AC , proceeding from the right Side of the Object, passes through A; the Ray CE will be parallel to the Axis AI , and therefore after Refraction in the Eye-Glass, will fall in with it in its Focus G. Since then, the Eye is placed near it, and all the other Rays proceeding from the same Point of the Object with E G, are refracted parallel thereto; the Point in the right Side of the Object, will be seen in the right Line E G.

After the like Manner it appears, that the middle Point of the Object is seen in the Axis G B, so that the Object appears inverted.

3. From what has been already shewn, it appears, that the Semi-Diameter of the Object will be seen thro'

the *Telescope*, under the Angle F G I, which to the naked Eye placed in A, is seen under the Angle bAC . Suppose now I F equal to the Distance of the Focus I G; since the right Angles at I are equal, $EFG = EFI$. Therefore, drawing F M, parallel to A C, we shall have $IFM = BAC$. — The Semi-Diameter, therefore, viewed with the naked Eye, is to that viewed through the *Telescope*, as I M to I E; draw K E parallel to F M, we shall have $IM : IE :: IF : IK$; but by Reason of that Parallelism of the Lens, $CE = BI = BF + FI = AB + FI$; and by Reason of the Parallelism of the right Lines C A and E K, $CE = AK$, therefore $BI = AK$, consequently $AB = IK$. And therefore $IM : IE :: IF : AB$; that is, the Semi-Diameter seen with the naked Eye, is to the Semi-Diameter viewed through the *Telescope*, in the Ratio of the Distance of the Focus of the Eye-Lens I F, to the Distance of the Focus of the Object-Glass A B.

Hence, 1. As the *Astronomical Telescope* exhibits Objects inverted; it serves commodiously enough, for observing the Stars (it signifying little, whether they be seen erect or inverted) but for terrestrial Objects, it is much less proper, as the inverting frequently prevents their being known.

2. If between the Eye-Glass, and its Focus G, be a plain well polished Speculum L N, of the Length of an Inch, and of an oval Figure, inclined to the Axis, under an Angle of 45° , the Rays E P and M Q will be reflected in such Manner, as that concurring in g, they make an Angle P g Q, equal to P G Q: And therefore the Eye being placed in g, will see the Object of the same Magnitude as before, only in an erect Situation. By the Addition therefore of such a Speculum, the *Astronomical Telescope* is render'd fit to observe terrestrial Objects.

3. Since the Focus of a Glass, convex on both Sides, is distant from the Glass itself a Semi-Diameter; and that of a plano-convex Glass, a Diameter: If the Object-Glass be convex on both Sides, the *Telescope* will magnify the Semi-Diameter of the Object, in the Ratio of the Semi-Diameter of the Eye-Glass to the Semi-Diameter of the Object-Glass; but if the Object-Glass be a Plano-Convex, in the Ratio of the Semi-Diameter of the Eye-Glass, to the Diameter of the Object-Glass.

4. Wherefore, since the Semi-Diameter of the Eye-Glass has a greater Ratio to the Semi-Diameter of the Object-Glass, than to its Diameter, a *Telescope* magnifies the Semi-Diameter of the Object more, if the Object-Glass be a Plano-Convex, than if convex on both Sides.

5. The Ratio of the Semi-Diameter of the Eye-Glass, to the Diameter or Semi-Diameter of the Object-Glass, is the less, as the Eye-Glass is a Segment of a less Sphere, and the Object-Glass of a greater. A *Telescope*, therefore, magnifies the Diameter of the Object more, as the Object-Glass is a Segment of a greater, and the Eye-Glass of a lesser Sphere. And yet the Ratio of the Semi-Diameter of the Eye-Glass to the Object-Glass, must not be too small; if it be, it will not refract Rays enough to the Eye from each Point of the Object; nor will it separate those coming from different Points sufficiently: By which Means, the Vision will be render'd obscure and confused. To this may be added, what we have shewn of the Ratio of the Object-Glass to the Eye-Glass in the *Dutch Telescope*.

De Chales observes, that an Object-Lens of $2\frac{1}{2}$ Feet, will require an Eye-Glass of $1\frac{1}{2}$ Digit, or Tenth of a Foot; and an Object-Glass of eight or ten Feet, an Eye-Glass of 4 Digits; in which he is confirmed by *Eustachio de Divinis*.

Huygens's great *Telescope*, wherewith *Saturn's* true Face, and one of his Satellites, were first discovered, consists of an Object-Glass of 12 Feet, and an Eye-Glass of a little more than 3 Digits. Though he frequently used a *Telescope* 23 Feet long, with two Eye-Glasses joined together, each, in Diameter, $1\frac{1}{2}$ Digit; so that the two were equal to one of 3 Digits. The same Author observes, that an Object-Glass of 30 Feet, requires an Eye-Glass of $3\frac{1}{2}$ Digits; and gives us a Table of Proportions, for the constructing of *Astronomical Telescopes*; an Abridgement whereof we shall here give the Reader.

| Dist. of Focus of Obj. Glass. | Diameter of Apert. | Dist. of Focus of Eye-Glass. | Mag. Diameter. |
|----------------------------------|-----------------------|---------------------------------|----------------|
| Rhineland Feet. | Digits and Decim. | Digits and Decim. | |
| 1 | 0 55 | 0 61 | 20 |
| 2 | 0 77 | 0 85 | 28 |
| 3 | 0 05 | 1 05 | 34 |
| 4 | 1 09 | 1 20 | 40 |
| 5 | 1 23 | 1 35 | 44 |

| | | | |
|----|------|------|----|
| 6 | 1 34 | 1 47 | 49 |
| 7 | 1 45 | 1 60 | 53 |
| 8 | 1 55 | 1 71 | 56 |
| 9 | 1 64 | 1 80 | 60 |
| 10 | 1 73 | 1 90 | 63 |

| Dist. of Focus of Obj. Glass. | Diameter of Apert. | Dist. of Focus of Eye-Glass. | Mag. Diameter. |
|----------------------------------|-----------------------|---------------------------------|----------------|
| Rhineland Feet. | Digits and Decim. | Digits and Decim. | |
| 15 | 2 12 | 2 33 | 72 |
| 20 | 2 45 | 2 70 | 89 |
| 25 | 2 74 | 3 01 | 100 |
| 30 | 3 00 | 3 30 | 109 |
| 40 | 3 46 | 3 56 | 126 |

| | | | |
|-----|------|------|-----|
| 50 | 3 87 | 4 26 | 141 |
| 60 | 4 24 | 4 66 | 154 |
| 70 | 4 58 | 5 04 | 166 |
| 80 | 4 90 | 5 39 | 178 |
| 90 | 5 05 | 5 56 | 183 |
| 100 | 5 48 | 9 03 | 199 |

If in two or more *Telescopes*, the Ratio between the Object and the Eye-Glass be the same, the Object will be magnified the same in both.

Hence some may conclude the making of large *Telescopes* a needless Trouble. But it must be remembered what we have already laid down: An Eye-Glass may be in a less Ratio to a greater Object-Glass than to a smaller; thus, e. gr. in *Huygen's* Telescope of 25 Feet, the Eye-Glass is three Digits. Now, keeping this Proportion in a Telescope of 50 Feet, the Eye-Glass should be six Digits; but the Table shews four and a half are sufficient. Hence from the same Table it appears, that a Telescope of 50 Feet magnifies in the Ratio of 1:141; whereas that of 25 Feet only magnifies in the Ratio of 1:100.

Since the Distance of the Lens's is equal to the Aggregate of the Distance of the Foci of the Object and Eye-Glasses; and the Focus of a Glass convex on each Side, is a Semi-diameter's Distance from the Lens; the Length of a Telescope is equal to the Aggregate of the Semi-diameters of the Lens's, if the Object-Glass be convex on both Sides; and to the Sum of the Semi-diameter of the Eye-Glass, and of the Diameter of the Object-Glass, if the Object-Glass be a Plano-convex.

But as the Semi-diameter of the Eye-Glass is very small, in respect of that of the Object-Glass, the Length of the Telescope is usually estimated from the Distance of the Object-Glass, i. e. from its Semi-diameter, if it be convex on both Sides; or its Diameter, if plano-convex. Thus a Telescope is said to be 12 Feet, if the Semi-diameter of the Object convex Glass on both Sides be 12 Feet, &c.

Since *Myopes* see near Objects best; then the Eye-Glass is to be removed nearer the Object-Glass, that the Rays refracting thro' it may be the more diverging.

To take in the larger Field at one View some use two Eye-Glasses, the foremost whereof is a Segment of a larger Sphere than that behind: To this it must be added, that if two Lens's be joined immediately together, so as one touch the other, the Focus is removed to double the Distance which that of one of them would be at.

To shorten the *Astronomical Telescope*, i. e. to construct a Telescope, so as that tho' shorter than a common one, it shall magnify as much.

1. Having provided a drawing Tube, fit an Object Lens E G (fig. 36.) which is a Segment of a moderate Sphere; let the first Eye-Glass be concave on both Sides, and so placed in the Tube, as that the Focus of the Object-Glass may be behind it, but nearer to the Center of the Concavity: Then will the Image be thrown in Q, so as that G A : G I :: A B : Q I. — Lastly, fit in ano-

ther Object-Glass, convex on both Sides, and a Segment of a lesser Sphere, so as that its Focus may be in Q.

This Telescope will magnify the Diameter of the Object more, than if the Object-Glass were to represent its Image at the same Distance E Q, and consequently a shorter Telescope constructed this Way, is equivalent to a longer in the common Way.

Sir *Isaac Newton* furnishes us with another Method of contracting the Telescope, in his catoptrical or reflecting Telescope, the Construction whereof I have given in the Article *Catoptricks*.

Land Telescope, or *Day Telescope*, is a Telescope consisting of more than two Lens's, commonly of a convex Object-Glass, and three convex Eye-Glasses; or, a Telescope that exhibits Objects erect, yet different from that of *Galileo*. — It has its Name from being used to view Objects in the Day-time, on or about the Earth.

Note, That to construct a *Land* or *Day Telescope*. — A Tube being provided, fit in an Object-Glass, which is either convex on both Sides, or plano-convex, and a Segment of a large Sphere: To this add three Eye-Glasses, all convex on both Sides, and Segments of equal Spheres, disposing them in such Manner, as that the Distance of any two may be the Aggregate of the Distances of their Foci.

Then will an Eye applied to the last Lens, at the Distance of its Focus, see Objects very distinctly, and magnified in the Ratio of the Distance of the Focus of one Eye-Glass, to the Distance of the Focus of the Object-Glass.

For, 1. The Rays, from what has been already said, falling on the Object parallel, the Image of the Object will be represented invertedly at the Distance of the principal Focus; wherefore since this Image is in the Focus of the first Eye-Glass, the Rays, after a second Refraction, will become parallel; and thus falling on the third Lens, after a third Refraction, they exhibit the Image invertedly, that is, an erect Image of the Object. Since then this Image is in the Focus of the third Eye-Glass, the Rays after a fourth Refraction will become parallel, and in this Disposition the Eye will receive them, and consequently there will be distinct Vision, and the Object will appear erect.

2. If $I Q = I K$, that is, equal to the Focus of the Object-Glass, an Eye placed in M, will see the Semi-diameter of the Object increased in the Ratio of L M to K I; but the Ray A Q proceeding from the Focus Q of the Object Lens A B, after Refraction becomes parallel to the Axis I L, consequently the first Eye-Lens C D joins it to the Axis in M, the Distance of a Semi-diameter.

And since the Focus of the second Eye-Glass E F, is also in M, the Ray F H, after Refraction, will be parallel to the Axis N O, and therefore the third Eye-Glass will join it at the Axis in P, but the Semi-diameters of the Lens's G H and C D are supposed equal; therefore P O = L M. Wherefore since the Right Angles at O and L are equal, as also H O = C L, the Angle O P H is equal to C L M. The Semi-diameter of the Object therefore appears the same in P as in M, and is consequently magnified in the Ratio of L M, or P O to K I.

Hence, 1. An *Astronomical Telescope* is easily converted into a *Land Telescope*, by using three Eye-Glasses for one; and the *Land Telescope* on the contrary, into an *astronomical* one, by taking away two Eye-Glasses, the Faculty of magnifying still remaining the same.

2. Since the Distance of the Eye-Glasses is very small, the Length of the Telescope is much the same as if you only used one.

3. From the Construction it is evident, that the Length of the Telescope is found by adding five Times the Semi-diameter of the Eye-Glasses to the Diameter of the Object-Glass, if a Plano convex; or its Semi-diameter, if convex on both Sides.

Huygens first observed, both in the *Astronomical* and *Land Telescope*, that it contributes considerably to the Perfection of the Instrument, to have a Ring of Wood or Metal with an Aperture, a little less than the Breadth of the Eye-Glass, fixed in the Place where the Image is found to radiate upon the Lens next the Eye: By means hereby the Colours, which are apt to disturb the Clear-

ness and Distinctness of the Object, are prevented, and the whole Compass taken in at a View, perfectly defined.

Note, That some make Land-Telescopes of three Lens's, which yet represent Objects erect and magnified as much as the former. But such *Telescopes* are attended with great Inconveniencies, both as the Objects herein are tinged with false Colours, and as they are distorted about the Margin. Some again use four Lens's and even more; but since some Part of the Rays are intercepted in passing every Lens, Objects are hereby exhibited dim, and very feeble.

There is also a Kind of *Telescope* called *Binocular*, because both Eyes may be applied to it; and consequently the same Object be observed at the same Time by both. It consists of two Tubes, with two Sets of Glasses of the same Power, and adjusted to the same Axis; and has been pretended to represent Objects much larger and clearer than a single, or monocular Glass.

Note, That the Invention of the *Telescope* is one of the noblest, and most useful these Ages have to boast of; by means whereof the Wonders of the Heavens are discovered to us, and Astronomy brought to a Degree of Perfection, which former Ages could have no Notion of. Indeed the Discovery is owing rather to Chance than to Thought; so that it is the good Fortune of the Discoverer, rather than his Skill and Ability, we are indebted to: On this Account it concerns us the less to know, who it was first hit on this admirable Invention. It is certain it must be casual, since the Theory it depends on was not then known. *Johannes Baptista Porta*, a noble *Neapolitan*, is asserted by *Wolffius* to be undoubtedly the first that made a *Telescope*; from this Passage in his *Magia Naturalis*, printed in 1549; 'If you do but know how to join the two (*viz.* the concave and convex Glasses) rightly together, you will see both remote and near Objects, much larger than they otherwise appear, and withal very distinct. In this Way we have been of good Help to many of our Friends, who either saw remote Things dimly, or near ones confusedly; and have made them see every Thing perfectly.'—But it is certain *Porta* did not understand his own Invention; and therefore never troubled himself to bring it to greater Perfection, nor ever applied it to celestial Observations. What is more, the Account *Porta* gives of his concave and convex Lens's is so dark and indistinct, that *Kepler* who examined it, by particular Command of the Emperor *Rudolphus*, declared to that Prince that it was entirely unintelligible.—Fifty Years afterwards, a *Telescope* 12 Inches long was made and presented to Prince *Maurice* of *Nassau*, by a Spectacle-maker of *Middlebourg*; but Authors are divided about his Name. *Sirtutus*, in a Treatise of the *Telescope*, printed Anno 1618, shews it to be *Zachary Jansen*, or, as *Wolffius* has it, *Hansen*.—*Job. Lapreus*, another Workman of the same Town, passes for a third Inventor; having made one in 1610, on the mere Relation given him of that of *Zachary*. In 1620 *James Metius*, Brother of *Adrian Metius*, Professor of Mathematicks at *Franker*, came with *Drebel* to *Middlebourg*, and there bought *Telescopes* of *Zachary's* Children, who had made them publick; and yet *Adrian Metius* has given his Brother the Honour of the Invention, in which he is mistakenly followed by *Des Cartes*. But none of these Artificers made *Telescopes* of above a Foot and a Half: *Simon Marius* in *Germany*, and *Galileo* in *Italy*, first made long ones fit for celestial Observations. *Le Rossi* relates, that *Galileo* being then at *Venice*, was told of a Sort of optick Glass made in *Holland*, which brought Objects nearer: Upon which setting himself to think how it should be, he ground two Pieces of Glass into Form, as well as he could, and fitted them to the two Ends of an Organ-Pipe, and shewed at once all the Wonders of the Invention to the *Venetian* Noblesse on the Top of the Tower of *St. Mark*. That Author adds, that from this Time *Galileo* devoted himself wholly to the improving and perfecting the *Telescope*; and that he thereby almost deserved all the Honour usually done him, of being reputed the Inventor of the Instrument,

and of its being denominated from him *Galileo's Tube*. *F. Mabillon* indeed relates, in his Travels through *Italy*, that in a Monastery of his own Order he saw a manuscript Copy of the Works of *Comestor*, written by one *Coradus*, who lived in the 13th Century; in the third Page whereof was seen a Portrait of *Ptolemy*, viewing the Stars through a Tube of four Joins or Drawers: But that Father does not say that the Tube had Glasses in it. In effect, it is more than probable, that such Tubes were then used for no other Purpose but to preserve and direct the Sight, or to render it more distinct by singling out the particular Object looked at, and shutting out all the foreign Rays reflected from others, whose Proximity might have rendered the Image less precise.

This Conjecture is verified by Experience, we having often observed, that without a Tube, by only looking through the Hand, or even the Fingers, or a Pin-hole in Paper, Objects shall appear more clear and distinct than otherwise.

Be this as it will, it is certain the optical Principles whereon *Telescopes* are founded, are contained in *Euclid*, and were well known to the antient Geometricians; and it is for want of Attention thereto, that the World was so long without that admirable Invention, as no doubt there are numerous others lying hid in the same Principles, only waiting for Reflection or Accident to bring them forth. From this I'll pass to the *Microscope*.

A *MICROSCOPE*, is a dioptrical Instrument, by means whereof very minute Objects are represented exceedingly large, and viewed very distinctly, according to the Laws of Refraction.

Microscopes, are properly distinguished into simple, or single; and compound or double.

Single Microscopes, are those which consist of a single Lens, or a single Spherule.

Compound Microscopes, consist of several Lens's duly combined.

As *Optics* have been improved, other Varieties have been contrived, in the Sorts of *Microscopes*; hence reflecting *Microscopes*, *Water Microscopes*, &c.

With regard to the Foundation and Theory of *single Microscopes*.—If an Object *A B* (fig. 34.) be placed in the Focus of a small convex Lens, or a *simple Microscope* *D E*, and the Eye be applied close to the other Side of the *Microscope*, the Object will be seen distinct in an erect Situation, and magnified in the Ratio of the Distance of the Focus, to the Distance wherein Objects are to be placed to be seen distinctly with the naked Eye.

For the Object *A B*, being placed in the Focus of the convex Lens *D E*, the Rays issuing from the several Points thereof after Refraction, will be parallel to each other. Consequently the Eye will see it distinctly, by virtue of what we have proved in speaking of *Telescopes*.

Farther, since one of the Rays *A F* proceeding from the Point *A*, after Refraction, becomes parallel to the incident Rays; and therefore setting aside the Thickness of the Lens, is found directly against it; and the same holds of all the other Rays carried to the Eyes: The Rays *A F* and *B F*, to which the rest coming from *A* and *B* are parallel, will enter the Eye in the same Manner as if they had entered without passing through the Lens, and will therefore appear erect, as if the Lens were away.

Lastly, it is manifest that the Object *A B* will be seen under the same Angle, as if viewed by the naked Eye: But since it appears very distinct, whereas to the naked Eye, at the same Distance, it would appear extremely confused, it is the same Thing as if the Object should seem removed to the Distance *F H*, wherein it is viewed with equal Distinctness, and under the same Angle. The Diameter of the Object *A B* therefore, will be to the apparent Diameter *I K* as *F C* to *F H*, *i. e.* as the Distance of the Focus of the Lens to the Distance wherein an Object is to be placed in order to view it distinctly.

Huygens takes it for granted, that an Object seen with the naked Eye is then in its utmost Distinctness, when seen at the Distance of eight Digits, or Tenths of a Foot; which agree pretty near with the Observations of others.

The Laws of *simple Microscopes*, are,—1. That *single Microscopes*

Microscopes magnify the Diameter of the Object A B, in the Ratio of the Distance of the Focus F C to an Interval of eight Digits; *v. gr.* if the Semi-diameter of a Lens convex on both Sides be half a Digit, A B; $IK = \frac{1}{2} \cdot 8 = 1 : 16$, that is, the Diameter of the Object will be increased in a sedecuple Proportion, or as sixteen to one.

2. Since the Distance F H is constant, *viz.* eight Digits, by how much Distance of the Focus F C is smaller, so much the smaller Ratio will it have to F H; consequently the Diameter of the Object will be so much the more magnified.

3. Since in the plano-convex Lens, the Distance of the Focus is equal to the Diameter; and in Lens's convex on both Sides, to the Semi-diameter; *simple Microscopes* will enlarge the Diameter so much the more, as they are Segments of smaller Spheres.

4. If the Diameter of the Convexities of a plano-convex Lens, and a Lens convex on both Sides, be the same, *viz.* $= 1$; the Distance of the Focus of the first will be 1, of the second $\frac{1}{2}$; consequently the Semi-diameter of the Object A B, will be to the apparent one in the first Case as 1 to 8, in the latter as $\frac{1}{2}$ to 8, *i. e.* as 1 to 16. A Lens therefore convex on both Sides magnifies twice as much as a plano-convex.

As the whole depends on the just and steady Situation of Objects with regard to the Lens, various Methods have been contrived to that End; whence we have several Kinds of *Microscopes*; the most simple is as follows.

1. A B (fig. 34.) is a little Tube, to one of whose Bases B C, is fitted a plain Glass, to which an Object, *viz.* a Gnat, Wing of an Insect, Down, or the like, is applied: To the other Base, A D, at a proper Distance from the Object is applied a Lens convex on both Sides, whose Semi-diameter is about half an Inch. The plain Glass is turned to the Sun, or the Light of a Candle, and the Object is seen magnified: And if the Tube be made to draw out, Lens's of different Spheres may be used.

Again, a Lens convex on both Sides, is inclosed in a Cell A C (fig. 35.) and by a Screw H, there fastened across; through the Pedestal C D passes a long Screw, by means whereof, and the female Screw I, a Style or Needle fixed perpendicular to its Extreme, is kept firm at any Distance from the Lens. In E is a little Tube, on which, and on the Point G, the various Objects are to be disposed; there may be Lens's of various Spheres applied.

2. But the *Microscope*, which is found to answer the End best is as follows; A B, fig. 39. is a round Brass Tube, whose exterior Surface is formed into a Screw of a Length somewhat less than the Distance of the Focus of a Glass convex on both Sides, used here for illuminating the Object, and fitted to its Base A C, by a Ring with a Screw in it D E.

F G, is another Brass Tube, somewhat wider than the first, and open each Way for an Object to be applied to the *Microscope*. To its upper Base G H, is fastened a Spring of Steel Wire, twisted into a spiral I, whereby an Object placed between two round Plates, or Slices, K and L, in the Manner hereafter mentioned, is by means of the Screw B C, brought to the microscopical Lens (or magnifying Glass, whereof there are several) and kept firm in its Place, to the Basis H G, which has a female Screw M, are fitted Cells N, with a male Screw O, wherein Lens's of various Spheres guarded by Ferrils, are included. In P is a female Screw, by which an Ivory Handle P Q is fastened to the *Microscope*.

In the Ivory Slice T are round Holes, in which are fitted little Circles of Muscovy Talc for Objects, especially small and pellucid ones, as little Insects, or the Wings, Scales, &c. of larger to be fastened to.

When live Insects are to be viewed, they are covered with the Brass Slice Y, which is put in a little square Brass Bed, perforated with Hole X; and the same Slice, whether alone, or enclosed in the Bed, being laid between the round Plates K and L, is brought to the Lens by means of the Screw A B, till the Object may be distinctly viewed.

If other pellucid oblong Objects are to be viewed, as Down, Cuticle, &c. instead of the Slice above, is used the Instrument, mentioned above for viewing Wings of

Flies; whose Structure is manifest by Inspection.

There are other Instruments in the Apparatus of the *Microscope*, as little Tongs, &c. for taking up small Objects, a Glass Tube for viewing the Circulation of the Blood in Fishes, &c. which need no Description.

What has been said hitherto, is to be understood of *lenticular Microscopes*; for spherical ones, their Doctrine will be understood from what follows.

If an Object A B (fig. 40.) be placed in the Focus of a Glass Spherule F, and the Eye be behind it, *v. gr.* in the Focus G, the Object will be seen distinct in an erect Situation, and magnified, as to its Diameter, in a Ratio of $\frac{1}{2}$ of the Diameter E I, to the Distance at which Objects are to be placed, to be seen distinctly with the naked Eye.

The first Part of the Proposition is proved in the same Manner of Spheres, as of Lens's; as then a good Eye sees an Object distinctly at the Distance of eight Digits, a Glass Spherule will enlarge the Diameter of an Object in a Ratio of $\frac{1}{2}$ of the Diameter to 88 Digits. Suppose then the Diameter of the Spherule, E I $\frac{1}{10}$ of a Digit, C E will be $= \frac{1}{10} + \frac{1}{10} = \frac{1}{5}$: Consequently, the true Diameter of an Object to its apparent one is in the Ratio of $\frac{1}{5}$ to 8, *i. e.* as 3 to 320, or 1 to 103 nearly.

Now a Lens convex on both Sides, increases the Diameter in a Ratio of the Semi-diameter, to the Spaces of eight Digits; wherefore $\frac{1}{2}$ having a less Ratio to 8 than $\frac{1}{5}$; if a Lens and a Sphere have the same Diameter, the former will magnify more than the latter, and pretty much after the same Manner it may be shewn, that a Sphere of a less Diameter, magnifies more than that of a large one.

Note, That there are various Methods of casting little Spherules for *Microscopes*. *Wolffius* describes one as follows: A small Piece of very fine Glass, sticking to the wet Point of a Steel Needle, is to be applied to the extreme bluish Part of the Flame of a Torch; or, which is better, to the Flame of Spirit of Wine, to prevent its being blackned. Being there melted, and run into a little round Drop, it is to be removed from the Flame; upon which it instantly ceases to be fluid: Folding then a thin Plate of Brass, and making very small smooth Perforations, so as not to leave any Roughness on the Surfaces; and further, smoothing them over to prevent any grating: Fit the Spherule between the Plates against the Apertures, and the whole in a Frame, with Objects convenient for Observation.—*Dr. Adams* gives another Method, thus: Take a Piece of fine Window-Glass, and raise it with a Diamond into as many Lengths as you think needful, not exceeding an Eighth of an Inch in Breadth; then holding one of those Lengths between the Fore-Finger and Thumb of each Hand over a very fine Flame till the Glass begins to soften; draw it out till it be as fine as an Hair, and breaks; then applying each of the Ends into the purest Part of the Flame, you have two Spheres presently, which you may make larger or less at Pleasure. If they stay long in the Flame they'll have Spots; so they must be drawn out immediately after they are turned round. As to the Stem, break it off as near the Ball as possible, and lodging the Remainder of the Stem between the Plates, by drilling the Hole exactly round, all the Protuberances are buried between the Plates; and the *Microscope* performs to Admiration. After those Manners may Spheres be made much smaller than any Lens; so that the best *Microscopes*, or those which magnify the most, are made thereof. For suppose the Diameter of a Spherule to be $\frac{1}{10}$ of a Digit, the Distance of its Focus will be $\frac{1}{10}$; and therefore its real Diameter to its apparent one is $\frac{1}{10} + \frac{1}{10}$; that is, as $\frac{1}{5}$ to 8, or as 3 to 512; or lastly, as 1 to 170. Its Surface therefore will be increased in the Proportion of 1 to 28900, and its Bulk in a Ratio of 1 to 4913000. *M. Luwenback* and *M. Muschenbrack*, have succeeded very well in spherical *Microscopes*; and the Apparatus of the latter is much commended: But we forbear any Descriptions thereof, it being easy for any who considers the Structure of those consisting of Lens's, to conceive how those of Spheres may be contrived.

As to *Water-Microscopes*.—*M. S. Gray*, and after him

him *Wolfius*, and others, have contrived *Water Microscopes*, consisting of Spherules or Lens's of Water instead of Glafs, fitted up somewhat after the Manner abovemention'd (as Spheres of Water may be likewise used instead of Glafs in any of the common *Microscopes*) but since the Distance of the Focus of a Lens or Sphere of Water, is greater than one of Glafs (the Spheres whereof they are Segments being the same) Water Microscopes magnify less, and are therefore less esteemed than those of Glafs. The same Mr. *Gray* first observed, that a small Drop of hemispherale Water held to the Eye by Candle-light or Moon-light, without any other Apparatus, magnified the Animalcule contained in it, vastly more than any other *Microscope*. The Reason is, that the Rays coming from the interior Surface of the first Hemisphere, are reflected so as to fall under the same Angle on the Surface of the hind Hemisphere, to which the Eye is applied, as if they came from the Focus of the Spherule, to which the Eye is applied; whence they are propagated to the Eye in the same Manner as if the Objects were placed without the Spherule in its Focus.

Hollow Glafs Spheres, of the Diameter of about half a Digit, filled with Spirit of Wine, are frequently used for *Microscopes*; but they do not magnify half so much.

As to the Theory of compound, or double Microscopes.—Suppose an Object-Glafs E D, fig. 43. the Segment of a very small Sphere, and the Object A B placed without the Focus F.

Suppose an Eye-Glafs G H, convex on both Sides, and the Segment of a Sphere greater (though not too great) than that of D E, and let it be so disposed behind the Object, as that if C E: C L:: C L: C K, the Focus of the Eye-Glafs may be in K.

Lastly, suppose L K: L M:: L M: L I.

If then O be the Place wherein an Object is seen distinct with the naked Eye; the Eye in this Case being placed in I, will see the Object A B in an inverted Situation, and magnified in a compound Ratio of M K to L K and L C to C O; as is proved from the Laws of Dioptricks.

The Laws of double Microscopes are,—1. The more an Object is magnified by the *Microscope*, the less is its Field, *i. e.* the less it takes in at one View.

2. To the same Eye-Glafs may be successively applied Object-Glasses of the same Spheres, so as that both the entire Objects, but less magnified, may be viewed thro' the same *Microscope*. In which Case, by reason of the different Distance of the Image, the Tube L K, in which the Lens's are fitted, should be made to draw out. For the Proportion of the Object-Glafs to the Eye-Glafs some commend the subduple Ratio, and some the subsextile. *De Chales* will have the Semi-diameter of the Convexity of the Object-Glafs to be $\frac{1}{2}$ of a Digit; or at most $\frac{1}{3}$, in the Eye-Glafs an entire Digit, or even 1 $\frac{1}{2}$. *F. Cherubin* makes the Semi-diameter of the Object-Glafs $\frac{1}{4}$, $\frac{1}{3}$ or $\frac{1}{2}$ of a Digit; the Semi-diameter of the Eye-Glafs 1 $\frac{1}{4}$, or 1 $\frac{1}{2}$ of a Digit.

Since it is proved, that the Distance of the Image L K from the Object-Glafs D E, will be greater, if another Lens concave on both Sides be placed before its Focus; it follows that the Object will be magnified the more, if such Lens be here placed between the Object-Glafs D E, and the Eye-Glafs G H.—Such a *Microscope* is much commended by *Comradi*, who used an Object-Lens convex on both Sides, whose Semi-diameter was two Digits, its Aperture equal to a Mustard-Seed; a Lens concave on both Sides, 12, or at most 16 Digits; and an Eye-Glafs convex on both Sides, of 6 Digits.

4. Since the Image is projected to the greater Distance, the nearer another Lens of a Segment of a larger Sphere, is brought to the Object-Glafs; a *Microscope* may be composed of three Lens's, which will magnify prodigiously.

5. From these Considerations it follows, that the Object will be magnified the more, as the Eye-Glafs is the Segment of a smaller Sphere; but the Field of Vision will be the greater; as the same is a Segment of a larger Sphere: If then two Eye-Glasses, the one a Segment of a large, the other of a small Sphere, be so combined, as that the Object appearing very near thro' them, *i. e.* not further distant than the Focus of the first, be yet distinct; the Object at the same Time will be ex-

ceedingly magnified, and the Field of Vision much greater than if only one Lens were used; and the Object will be still more magnified, and the Field enlarged, if both the Object and the Eye-Glafs be double. But in regard an Object appears dim, when viewed through so many Glasses, Part of the Rays being reflected in passing thro' each; the multiplying of Lens's is not advisable: And the best among compound *Microscopes* are those which consist of one Object-Glafs and two Eye-Glasses.

For a *Microscope* of three Lens's, *De Chales* uses an Object Glafs of $\frac{1}{2}$ or $\frac{1}{3}$ of a Digit; the Distance between the Object-Glafs and Eye-Glafs about twenty Lines. *Comradi* had an excellent *Microscope*, the Object-Glafs whereof was half a Digit, and the two Eye-Glasses (which were placed very near) four Digits: But it answered best, when in lieu of the Object-Glafs, he used two Glasses convex on both Sides, their Sphere about a Digit and a half, or at most two, and their Convexities touching each other, within the Space of half a Line. *Eustathius de Divinis*, instead of an Object-Glafs convex on both Sides, used two plano-convex Lens's whose Convexities touched. *Grindelius* did the same, only that the Convexities did not quite touch. *Jahnius* made a Binocular *Microscope*, wherein both Eyes were used.

The most commodious double *Microscope*, is of the Contrivance of Mr. *Marshall*, an *Englishman*. In this the Eye-Glasses are placed in the Tube at A and B (fig. 47.) and the Object-Glafs at C, the little Pillar D E is turned by means of a Ball F, movable in the Socket F; and thus the *Microscope* is accommodated to any Situation. The same Pillar is divided into as many Parts, 1, 2, 3, 4, 5, &c. as there are Lens's of different Spheres to be used in viewing different Objects; so that the Distance of the Object from the Object-Glafs may be found without any Trouble. But as it is scarce exactly enough determined this Way, the Tube may be brought nearer the Object at Discretion, by means of the Screw G H.

The Objects are either laid on the Circle I, or fitted to proper Instruments, having their Points or Stiles passing through the little Tube I M.

Lastly, to illuminate the Object, a Lens convex on both Sides, is disposed in a convenient Situation.

Note, That there are reflecting *Microscopes* which magnify by Reflection as the above-mentioned ones do by Refraction. The Structure of such a *Microscope* may be conceived thus; near the Focus of a common Speculum A B C (fig. 48.) place a minute Object C, that its Image may be formed larger than itself in D. To the Speculum join a Lens convex on both Sides E F, so as the Image D may be in its Focus. The Eye will here see the Image inverted, but distinct and enlarged; consequently the Object will be larger than if viewed through the Lens alone. Sir *Isaac Newton* has invented this *Microscope*, but it is somewhat to be feared lest the Object appear dim.

Note, also, That any Telescope is converted into a *Microscope*, by removing the Object-Glafs to a greater Distance from the Eye-Glafs. And since the Distance of the Image is various, according to the Distance of the Object from the Focus; and it is magnified the more, as its Distance from the Object-Glafs is greater; the same Telescopes may be successively converted into *Microscopes*, which magnify the Object in different Degrees.

Note, besides, That the next Thing which occurs are Spectacles.

SPECTACLES, are an optick Machine, consisting of two Lens's set in Horn or other Matter, and applied on the Nose, to assist in defect of the Organ of Sight.

Old People, and all Presbyters, use Spectacles of convex Lens's, to make amends for the Flatness of the Eye, which does not make the Rays converge enough to have them meet in the Retina.

Short-sighted People, or Myopes, use concave Lens's, to keep the Rays from converging so fast, through the great Roundness of the Eye, as to make them meet ere they reach the Retina.

In Spain, and at Venice especially, Spectacles are used with a different View: All the People of Note and Fashion

shion there, have them continually on their Noses; a Folly that has its Source in the natural Pride of those People, who value themselves on a profound Wisdom; and affect to stare very near at every Thing, as if their Eyes were weaken'd, and wore out with Excess of Attention. I never laughed more heartily, than the first Time I saw in *Portugal*, a Man mounted on a Mule, with huge *Spectacles* on his Nose; and having enquired afterwards what could be the Signification of so grotesque a Figure, I was told, that *Spectacles* on the Nose of a *Portuguese*, had the same Signification, as the Doctoral Cap in *France*, and that those Gentlemen of the *Spectacles*, were Doctors, though the Doctrine of most of them consisted in the Largeness of their Spectacles.

F. *Cherubin*, a *Capuchin*, describes a Kind of *Spectacle-Telescopes*, for the viewing of remote Objects with both Eyes; hence called *Binoculi*, in *French*, *Binocles*. Though Father *Rheita* had mentioned the same before him, in his *Oculus Enoch* and *Eliæ*. The same Author invented a Kind of *Spectacles*, with three or four Glasses, which performed extraordinarily.

Spectacles were certainly unknown to the Antients; yet are they not of so late a Date as the Telescope. *Francisco Redi*, in a very learned Treatise on *Spectacles*, will have them to have been invented in the 13th Century, between the Years 1280, and 1311; and adds, that *Alexander Despina*, a Monk of the Order of Predicants of *St. Catherine*, at *Pisa*, first communicated the Secret, which was of his own Invention; upon learning that another Person had it as well as himself. The History is wrote in the Chronicles of that Convent.

The same Author tells us, that in an old Manuscript, still preserved in his Library, composed in 1299, *Spectacles* are mentioned as a Thing invented about that Time: And that a famous *Jacobine*, one *Jordan de Rivolto*, in a Treatise composed in 1305, says expressly, that it was yet 20 Years since the Invention of *Spectacles*. He likewise quotes *Bernard Gordon*, in his *Lilium Medicinæ*, who wrote the same Year, where he speaks of a Collyrium, good to enable an old Man to read without *Spectacles*.

Du Conge, however, carries the Invention of *Spectacles* farther back; assuring us, that there is a *Greek Poem* in Manuscript, in the King of *France's* Library, which shews, that *Spectacles* were in Use in the Year 1150; nevertheless, the Dictionary of the Academy *Della Crusca*, under the Word *Occhial*, inclines to *Redi's* Side; and quotes a Passage from *Jourdan's* Sermons, which says, that *Spectacles* had not been 20 Years in Use: Now *Salviati* has observed, that those Sermons were composed between the Years 1330 and 1336.

Note, That from this I'll pass to the Description of a *Prism*, in *Dioptricks*; and to the Explication of the Phenomena thereof.

PRISM, in *Dioptricks*, is a Glass in Form of a triangular Prism, much used in Experiments about the Nature of Light and Colours.

Note, That *Prism*, in Geometry, whence this borrows its Name, is an oblong Solid or Body, contained under more than four Planes, and whose Bases are equal, parallel, and equally situated.

The Phenomena and Use of the *Prism*, arise from its separating the Rays of Light in their Passage thro' it.

The more general of these Phenomena are as follow: For to enumerate all would be endless; and even these are sufficient to demonstrate, that Colours do not either consist in the Contortion of Globules of Light, as *Des Cartes* imagined; nor in the Obliquity of the Pulses of the æthereal Matter, as *Hook* fancy'd; nor in the Contipation of Light, and its greater or less Concitation, as *Dr. Barrow* conjectured; but that they are original and unchangeable Properties of Light itself: Therefore the Phenomena of the *Prism* are as follow.

1. The Sun's Rays transmitted thro' a *Prism* to an opposite Wall, project an Image like the Rainbow, of various vivid Colours; the chief whereof are red, yellow, green, blue, and violet.

The Reason is, that the various colour'd Rays, which were before mixed and blended together, are now, in Virtue of their different Refrangibilities, separated by

Refraction, in passing thro' the *Prism*, and thrown each Colour by itself.

For the blue Rays, *v. gr.* represented by the dotted Lines, fig. 50. beginning to be separated from the rest in the Side *ca*, of the *Prism abc*, by the first Refraction in *dd*, are again separated further in the other Face of the *Prism bc*, by a second Refraction, the same Way in *ee*; whereas in a plain Glass, or even in a *Prism* in a different Position, the blue Rays separated by the first Refraction, are again mixed by the second Refraction, at the other Surface, which is made a contrary Way.

2. The Image thus projected, is not round; but when the Angle of the *Prism* is 60 or 65 Deg. about five times as long as broad.

Because some of the Rays are refracted more than others, and therefore exhibit several Images of the Sun, stretched out in length, as if it were but one.

3. Those Rays which exhibit the yellow Colour, swerve more from the rectilinear Course, than those which exhibit the red; and the green more than the yellow; and the violet most of all.

4. If the *Prism*, through which the Rays are transmitted, be turned about its Axis; so as the red, yellow, green, &c. Rays, be received in order on another *Prism* about 12 Feet distant from the former, through a little Hole, and thence projected further, the yellow, red, &c. Rays, though they fall in the same Manner, on the second *Prism*, yet will not be projected on the same Place as the red, but will be deflected further that Way towards which the Refraction is.

And if, in lieu of the second *Prism*, they be received on a Lens a little convex; the yellow, green, &c. Rays, will be collected each in its Order, into a nearer Focus than the red ones. The Reason of which two last Phenomena is, that the yellow Rays are refracted more than the red ones; the green ones more than the yellow ones, and the violet ones most of all.

5. The Colours of coloured Rays well separated, can neither be destroyed, nor in any Manner alter'd by repeated Refractions through a Number of *Prisms*; nor by passing through an illumined Space, nor by their mutual Decussations, nor by the Neighbourhood of the Shade, nor by being reflected from any natural Bodies.

Because their Colours are not Modifications arising from Reflection, but original and immutable Properties thereof.

6. All coloured Rays collected together in any Manner, either by several *Prisms*, or a convex Lens, or concave Speculum, form Whiteness; but being again separated after Decussation, each exhibits its proper Colour.

Because, as the Ray was white ere its Parts were separated by Refraction; so those Parts being remixed, it recovers its Whiteness; and the coloured Rays, when they meet, do not destroy one another, but only intermix.

Hence Dusts or Powders, red, yellow, green, blue, violet, &c. mixed in a certain Proportion, become grey; or of the Colour arising from a Mixture of black and white; and would be perfectly white, but that some of the Rays are absorbed.

Thus, if a Circle of Paper be smeared with all these Colours a-part, in a certain Proportion, and turn'd swiftly about its Center, so that the Species of the several Colours may be confounded in the Eye by the Velocity of the Motion, the several Colours will disappear, and the whole be seen of one uniform Colour between black and white.

7. If the Sun's Rays fall very obliquely on the inner Superficies of a *Prism*, the Rays reflected will be violet; those transmitted, red.

8. If there be two *Prisms*, the one full of a red Liquor, the other of a blue one; the two joined together will be opaque; though, if both be filled either with a blue or a red Liquor, they will together be transparent: For the one transmitting none but blue, the other none but red Rays, the two together will transmit none at all.

9. All natural Bodies, especially white ones, viewed through a *Prism* held to the Eye, seem fringed or hammed on one Side, with red and yellow, on the other with blue and violet.

10. If two *Prisms* be so placed, that the red of the one, and the purple of the other, meet on a Paper encompassed with Darknes, the Image will be pale; but viewed through a third *Prism*, held to the Eye at a due Distance, will appear double, red, and purple.

And if two Kinds of Powder, the one perfectly red, the other blue, be mixed, a little Body being covered thick with the Mixture, will exhibit a double Image, the one red, the other blue, through a *Prism* applied to the Eye.

11. If the Rays transmitted through a convex Lens be received on a Paper before they meet in the Focus, the Confine of Light and Shadow will seem tinged with a red Colour; if beyond the Focus, with a blue.

12. If the Rays about to be transmitted through one Part of the Pupil, be intercepted by the Opposition of some opaque Body near the Eye, the Extremes of Bodies laying beyond it, will seem tinged with Colours, as is seen through a *Prism*, though less vivid.

Because the Rays transmitted through one Part of the Pupil, are separated by Refraction into divers Colours; and the intercepted Rays, which would be refracted a contrary Way, are prevented from mixing and dilating them: Whence also it is, that a Body viewed with both Eyes, through two little Holes made in a Paper, does not only appear double, but tinged with Colours too.

Note, That *Euclid* has wrote on the antient *Opticks*, and *Catoptricks*: *Dioptricks* were unknown to them. *F. Honorat. Fabri* has an Abridgment of *Opticks*, *Catoptricks*, and *Dioptricks*: *Father Eschinard* has given a Century of Problems in *Opticks*; *Vitellio* and *Albazen*, have performed well on the Elements of *Opticks*. *Father Kircher* has a large Volume on the Secrets of *Opticks*, of Light and Shadow, and their surprizing Effects, which pass on the People for Magick. We have also *L'Optique* and *Catoptrique* of *Father Mersenne*, Paris 1651. *Dioptrique Oculaire* of *Father Cherubin*, Paris 1671. *Fol. Christoph. Cheiveri Optica*, London 1658. *Jacobi Gregorii Optices. Barrovii Lectiones Opticæ*, London 1663. *Job. Bapt. Porta, De refractione Optices*, London 1669. *Principes generales de l'Optique*, by *M. Leibnitz*, in the *Leipsick Acts*, 1642. *L'Occhiale a l'Occhia*, or *Dioptrica Practica*, *Carol. Anton. Manimé*, Bologna 1660, 4to. *Sir Isaac Newton's Opticks*, Latin and English 4to. and 8vo. &c.

A P P E N D I X.

Note, As the *Phosphorus* has some Relation to *Opticks*, in that it is consider'd as a luminous Matter; I take this Place to be the properest, to take a particular Notice of it: Therefore,

A *Phosphorus* (from the Greek *φως*, Light, and *φωρ*, I bear) is a Matter which shines, or even burns spontaneously, and without the Application of any sensible Fire.

Phosphorus, is either natural or artificial.

Natural PHOSPHORI, are Matters which become luminous at certain Times, without the Assistance of any Art or Preparation. Such are the *Glow-Worms*, frequent in cold Countries, *Rotten Wood*, the *Eyes*, *Blood*, *Scales*, *Flesh*, *Sweats*, *Feathers*, &c. of several Animals; *Diamonds* when rubbed after a certain Manner; *Sugar* and *Sulphur*, when pounded in a dark Place; *Sea-Water*, and some *Mineral-Waters*, when briskly agitated; a Cat's or Horse's Back, duly rubbed with the Hand, &c. in the Dark; nay *Dr. Croon* tells, that upon rubbing his own Body briskly with a well warmed Shirt, he has frequently made both to shine; and *Dr. Sloane* adds, that he knows a *Bristol Gentleman* and his Son, both whose Stockings will shine after much Walking.

All natural *Phosphori* have this in common, that they do not shine always, and that they never give any Heat.

But that which of all natural *Phosphori* has occasioned the most Speculation, is the *Barometrical* or *Mercurial Phosphorus*. *M. Picard* first observed, that the Mercury of his Barometer, when shaken in a dark Place, emitted Light, with this Circumstance, that in shaking the Mercury with Rapidity, sometimes above and sometimes below its Equilibrium with the Air, the Light was only seen when below it, where it appear'd as if adhering to the Surface.

But this Light is not found in the Mercury of all Barometers, which occasions a great Difficulty.

M. Bernoulli, upon examining the Circumstances of this Phænomenon, invented a Solution of the same: He imagines, that upon the Mercury's descending, the Vacuum in the Tube increasing, there issues out of the Mercury to fill up this Excess of Vacuity, a very subtile Matter, before dispersed throughout the Pores of this Mineral; and that, at the same Time, there enters through the Pores of the Tube, another finer Matter: Thus, the first Matter emitted from the Mercury, and collected over its Surface, striking impetuously against that received from without, has the same Effect with *Des Cartes's* first Element against the second; that is, produces the Motion of Light.

But why then is not the Phænomenon common to all Barometers? To this he answers, that the Motion of the subtile Matter out of the Mercury may be weaken'd, and prevented by any heterogeneous Matter collected on its upper Surface into a Kind of Pellicle: So that the Light should never appear but when the Mercury is perfectly pure.

This Reasoning was confirmed from the Experiment of several Barometers which he made according to the same Plane; but the Royal Academy of Sciences, who repeated Experiments with Barometers, made after the same Manner, did not meet with the same Success; the Light being found in some, not in others.

M. Homberg, therefore, conjectured, that the Difference consisted in the different Qualities of the Quicksilver: In some, he observed, they used Quicklime to purify; in others, Steel-filings. The Mercury, then rising in the Distillation, and passing through the Lime, might take away Parts thereof, capable, by their extreme Smallness, to lodge in its Interstices. Hence, as Quicklime always retains some fiery Particles, it is possible, in a Place void of Air, where they swim at Liberty, they may produce this Lustre.

M. Hawksbee has several Experiments on the mercurial *Phosphorus*. Passing Air forcibly through the Body of Quicksilver, placed in an exhausted Receiver, the Parts were violently driven against the Side of the Receiver, and gave all around the Appearance of Fire; continuing thus till the Receiver was again full of Air.

From other Experiments he found, that though the Appearance of Light was not producible by agitating the Mercury in the same Manner in the common Air; yet, that a very fine Medium, nearly approaching to a Vacuum, was not at all necessary.

And, lastly, from other Experiments he found, that Mercury inclosed in Water, which communicated with the open Air, by a violent shaking of the Vessel, wherein it was inclosed, emitted Particles of Light in great Plenry, like little Stars.

By including the Vessel of Mercury, &c. in the Receiver, and exhausting the Air, the Phænomenon was changed; and upon shaking the Vessel, instead of Sparkles of Light, the whole Mass appeared one continued Circle of Light.

* There are three Kinds of artificial *Phosphori*, i. e. of those which owe their luminous Quality to some Art or Preparation, viz. a burning one, which consumes every combustible it touches; and two others, which have no sensible Heat, and are called the *Bononian* and *Hermetic Phosphorus*.

The burning PHOSPHORUS may be made of Urine, Blood, Hair, and generally of any Part of an Animal, that yields an Oil by Distillation. The Matter it is most easily drawn from, is human Urine, in the following Manner.

Evaporate a good Quantity of Urine of Beer-Drinkers, to the Consistence of Honey. Cover it up in an earthen Vessel, and set it three or four Months in a Cellar to ferment or putrify. Mix a double Quantity of Sand, or Powder of Potshards, with one Part of this Urine; put it into a Retort, fitted to a long necked Receiver, with two or three Quarts of Water. Distil it at a naked Fire, in a reverberatory Furnace; at first gently; after two Hours, augment the Fire gradually, till all the black fetid Oil be drawn off. Rise the Fire to the highest Degree; upon which white Clouds will come into the Receiver, and fix by little and little on one Side, in Form

of a yellowish Skin; and another Part will precipitate to the Bottom in Powder. Keep the Fire thus violent for three Hours, till no more Fumes arise. Let all cool and unloose the Vessels; and throwing more Water into the Receiver, shake all well about to loosen what sticks to the Sides. Pour the whole into a Glass Vessel to settle.

The volatile Salt will now dissolve in the Water, and the *Phosphorus* and Oil sink to the Bottom; pour off the Water, and gathering the remaining Matter together, put it into a Glass Vessel with a little fresh Water, and digest it in a sand Heat, stirring it from Time to Time with a wooden Spatula.

By this Means the *Phosphorus* will separate from the Oil, and sink to the Bottom; pour off the Oil, and make up the *Phosphorus*, while hot, into Sticks for Use.

Boerhaave gives us other Ways of making *Phosphorus*. Recent Urine, he observes, digested three or four Times in a tall Glass, with a Heat no greater than that of a healthy Man, grows reddish, fetid, and cadaverous: This digested Urine being put to distil in a Retort, yields a clear fetid Liquor, then a yellow volatile Salt, which evaporated to the Consistence of a Sapor, and mixed with four Times its Weight of dry Sand, and the Distillation continued in a covered Retort; there successively comes over, by greater and greater Degrees of Fire, a fetid brown Oil, bluish Fumes, and a gross shining Matter, which sinks in Water, and is the solid *Phosphorus*.

To make it more directly, and to the best Advantage, it may be proper to take a sufficient Quantity of human Urine, afforded by a Person not much given to drink Wine, and exhale it away in an open Vessel to a Rob, or the Consistence of Honey; then set it to putrify for half a Year, and upon Distillation it will afford a large Proportion of Salt; after which, if six Times its own Quantity of Sand, or Brick-dust be added to the Remainder, and the Distillation be continued, as in the Case last mentioned, the *Phosphorus* will fall into the Water. Or it may commodiously be prepared, by suffering the Rob of Urine to digest for two Years in an open Vessel in the open Air; during which Time a stinky, scæulent, unctuous, earthy Matter, will fall to the Bottom; which being frequently washed with pure Water, wherein it will not dissolve, will leave a white Matter behind it, neither of an alkaline, acid, saline, or terrestrial, or scarce of an unctuous Nature: And this is of itself a proper Matter for making of *Phosphorus*, by Distillation with Sand.

To render this *Phosphorus* liquid, a little Bit of some Scrapings of it, must be put in Digestion, in Oil, or Essence of Cloves, Oil of Turpentine, and the like, in Horse-dung; after Dissolution, the Oil will be so impregnated with it, that upon opening the Bottle the Matter will appear in a Flame.

Note, That the Properties of the solid and liquid *Phosphorus*, are as follow.—1. If a little Bit of the solid be thrown into some of the strongest Oil of Vitriol, mixed with half the Quantity of common Water, and the Phial be shaken, the Mixture will grow very hot, and smok, and the *Phosphorus* fall into Powder to the Bottom. If the Operation be made in the Dark, the *Phosphorus* will be seen to light by the Heat of the Liquor, and Flashes of Light, like the Glittering of a Diamond, will appear in several Places of the Phial. The Liquor being cooled, produces the same Effect for a considerable Time, when the Phial is shaken; but the Light is not so strong then as it was at first.

2. The solid *Phosphorus*, mixed with Mercury, constitutes a luminous Amalgama, in this Manner: Put in a long Phial about six Grains of *Phosphorus*, and pour over it two Drachms of Oil of Aspic, the Phial being so big, that two Thirds thereof at least may remain empty: Heat it a little at the Light of a Candle, the *Phosphorus* will dissolve with Ebullition, pour into the Phial during that Dissolution half a Drachm of Quicksilver, shake the whole Mixture, and then will be formed an Amalgama, which will appear all on Fire in the Dark.

3. Camphor mixed with the *Phosphorus* does not interrupt the Light, but it hinders it from bursting into Flames, which is surprizing, since that Mixture

is almost all volatile Sulphur, which seems very agreeable to the Nature of the *Phosphorus*; therefore there must be in the Camphor a Kind of Salt, which fixes the Sulphur of the *Phosphorus*, and hinders it taking Fire.

4. With this *Phosphorus* one may write on Paper as with a Pencil, and the Letters appear like Flame in the Dark; yet in the Light nothing appears but Smoak.

5. A little Piece rubbed between two Papers takes Fire instantaneously. If Care be not taken in the Management of it, there is Danger of burning the Fingers, the *Phosphorus* being exceedingly inflammable. *M. Cassini* happening to press a Piece in a Cloth between his Fingers, the Cloth immediately took Fire; he endeavour'd to put it out with his Foot; but his Shoe caught the Flame, and he was obliged to extinguish it with a Brass Ruler, which cast forth Rays in the Dark for two Months after. *M. L'Emery* relates, that having made one Day some Experiments of the *Phosphorus* in his own House, he left unawares a little Bit of it on the Table of the Room. The Maid, in making the Bed, carried it off with the Blankets, which she had put upon it; the Person who laid in that Bed, having wak'd in the Night, because, perhaps, of some Heat he felt, perceived that the Blanket was on Fire. In fact, the *Phosphorus* having been excited by the Heat of his Body, had set the Blanket on Fire, and had made a great Hole in it.

3. The Air lighting the Fire, by exciting the Motion of its Parts, renders, likewise, the *Phosphorus* luminous, for when the Matter has remained; sometimes, in a Bottle well corked, it lights no more; and re-assumes its Light, when Air is given to it; by uncorking the Bottle. Notwithstanding which, some Experiments made at *Paris*, by *M. Homberg*; seem to shew, that Air is not always necessary to render the *Phosphorus* luminous. A very little Bit of the solid *Phosphorus* was put in a small Glass-Bottle, to which had been adapted a small Brass-Cock, which could be introduced into another Brass-Cock, of another Glass-Bottle, but very large. The Bottle which contained the *Phosphorus* was heated, and the Cock of that Bottle applied to that of the large Bottle, out of which the Air had been pumped. As soon as the Cocks were open'd, the Air came out of the little Bottle, together with large Flashes of Light, the little Bottle being separated from the little one, the Light diminished considerably, and was even seen, sometimes, almost extinguished; the Cock was open'd to let the Air enter, and presently the *Phosphorus* was seen to light again. Which, notwithstanding, the Heat of the *Phosphorus* diminished much, and gave but a dim Light: The Experiment was renewed, a large Glass-Bottle was adapted to the little one which contained the *Phosphorus*, and the Air being come out of the Bottle, the *Phosphorus* appeared more shining; on the contrary, when the Air was re-introduced into it, the *Phosphorus* was seen extinguished; which was entirely opposite to what happen'd when the Bottle of the *Phosphorus* was set in the former Experiment. The same Experiments were repeated several Times, and the same Thing happened every Time, *i. e.* that the *Phosphorus* being hot, lost much of its Light when the Air was pumped out of the Bottle it was contained in; and lighted again when the Air was introduced into it anew. The *Phosphorus*, on the contrary, being cold, lighted again when the Air was pumped out of the Bottle, and put out, by the Air being re-introduced into it. It suffices to have related the two Experiments, the most opposite to each other, to judge what might happen, when the *Phosphorus* is not so hot as in the first, nor so cold as in the second, the least Circumstance causing an Alteration in the Experiment.

What is the most surprizing in those Experiments, is, that the Air renders, sometimes, the *Phosphorus* luminous, and sometimes extinguishes it. To solve that Difficulty, I say, that in the first Experiment, the greatest Part of the luminous Matter of the *Phosphorus* was expelled, and what remained in the Bottle, after it was separated from the large one, being divested of its most subtle Sulphurs, was not capable to produce

as much Light as before: But as the Matter was yet hot, there arose from it a sufficient Quantity of Particles to give Light when the Bottle was uncorked, and as the Cold condenses the small Bodies, and makes them lose much of their Motion, that *Phosphorus* likewise lost much of its Force in cooling, and gave but a dim Light. When the Air was pumped out of the Bottle, the Matter appeared more shining, and by its being re-introduced into it, it was extinguished. The Reason of this is, that the Light being weak, it could not preserve itself without a sufficient Proportion of Air, and there was enough left in the Bottle; for let the Air be pumped out of a Vessel with ever so much Exactness, there remains always a little in it: The *Phosphorus* was extinguished by the Introduction of a great Quantity of Air, as the Snuff of a Candle is extinguished by an Air a little too strong; or as a small Fire is extinguished by too much Wind. While the *Phosphorus* supplies the Place with Abundance of Matter, it wants much Air to appear luminous, and a small Quantity of Air would not be sufficient; therefore, while the *Phosphorus* was hot, it gave no Light 'till the Bottle was uncorked; but when cooled, as none but weak Vapours were exalted from it, then there wanted but very little Air to render it luminous; and when too much was introduced into the Bottle, it was suffocated.

Note also, That the burning Phosphorus was invented by M. Kunkel, Chymist of the Elector of Saxony, brought into France by M. Kraft, a Physician of Dresden, by whom it was communicated to Mr. Boyle. In 1676, M. Elrbolt published a Treatise expressly on it at Berlin; and in 1680 Mr. Boyle published another in English, under the Title of Noctiluca. M. Homberg first made it at Paris in 1679, and communicated the Method of Preparation to the Publick.

When we consider the *Phosphori*, either *natural* or *artificial*, and the Experiments made on them, we must confess that the general Cause of the Light they give, proceeds from a too great Agitation of their insensible Parts; and as there is a great Appearance that the ordinary Fire is but a very violent Motion of small Bodies round their Centre, it may be said that the Parts of the *Phosphorus* have received the same Determinations by Fermentations, or by Fire; for Wood is luminous but when it is rotten; *i. e.* when it has received enough Fermentation, for its most subtile Parts to be moved with Rapidity round their Centre, the *Bononian Stone* is luminous, but after it has been calcined a certain Space of Time. A Cat is not luminous in its Body, but if you rub him hard on the Back, in the Night, it will produce Light; because in irritating the Animal by that extraordinary rubbing, you'll excite an Agitation of the Spirits, much stronger than it was before; and it may be said, *in Passent*, that a Cat's Eyes, which light in the Night, are a Kind of *Phosphorus*. A Viper, being irritated, thrusts out its Tongue with so much Rapidity, that it appears all on Fire. Several little Animals, as some Kinds of Caterpillars, and Wood Mille-Pedes, or Wood-Lice, in the Night, because they have towards the Tail a Matter so very subtile, that it produces a Kind of Fire; and it is for the same Reason of the Motion of the Parts, that Urine becomes luminous. What has given Room to work an Urine for the Discovery of this is, that it was observed, by Chance, that in Places where Urine had stood for some Time, Light was seen in the Night.

If I be asked why the greatest Parts of the Mixts do not give Light, though the same Means are used to put their Parts into Motion?

I'll answer, that all the Mixts have not their insensible Parts dispos'd to move themselves with the same Rapidity, and in the same Manner, as those above-mention'd; we may make a Flame with Wood, but we cannot do it with a Stone, because we cannot give the same Determination to the Parts of a Stone we give to those of Wood; Mixts, to give Light or Fire, must be composed of sulphurous Particles; for Sulphurs are very susceptible of Motion.

I don't question but we could find *Phosphori* in an infinite Number of Things, where we see none at present, if we would apply ourselves to search them.

It has been observed in several Men, that when they are in a Passion, or in a violent Agitation of Spirit, their Hairs shine like Fire, and we may easily believe what has been said of *Alexander the Great*, that while in the Heat of a Battle, his Eyes darted Fire, because he gave then an extraordinary Rapidity of Motion to his Humours. Linen, which has been kept seven or eight Days on the Body of a Man, provided it has all that Time touch'd his Flesh, becomes luminous; therefore shaking, in the Summer, a Shirt, at the Time it is left off, it gives Light.

What I have said on this Subject may very well pass for a general Explication; but when we descend into Particulars, it is very difficult to resolve several Doubts: For Instance, in what consists the Difference of Fermentations; which causes that of several semblable Matters, the one are shining, and the others not, though they seem to have received the same Elaborations and the same Fermentations in an equal Time? Why some having but very little fermented give Light, and others of the same Nature, though they have fermented as much or more, give none? Why certain Sides of a Matter are luminous, and the other not? One should know perfectly the Structure and Arrangement of the Matter, to account for all those Phænomena, and solve all those Difficulties.

We find, sometimes, in Butchers Shops, Pieces of Veal, Mutton, and Beef, which shine in the Night, though they are newly killed, and others killed at the same Time, which do not shine.

This Phænomenon, in my Opinion, may be attributed to two Causes, the first to the Pasture; for it is certain, that in certain Countries the Grass is more spirituous than in others, and therefore gives a greater Motion to the Humours of the Cattle which feed upon it, and a Disposition towards making that *Phosphorus*. The second to that those Beasts may have been more over-heated on the Road, than the others, and have, perhaps, been killed before they were cold enough; for the Spirits, being in a violent Agitation, do not entirely lose their Motion, though the Beast be killed; and while they continue to move with Rapidity, the *Phosphorus* appears; but when the Meat begins to grow stale, it is no longer luminous, because those subtile Spirits are either dissipated, or have been confounded in the Meat, by a new Fermentation begun.

It may be objected, perhaps, that if the *Phosphorus* consists in the violent Emotion of the insensible Parts, stinking Meat should rather shine, than that newly killed, since the offensive Smell proceeds wholly from the Principles of a Mixt, which having loosened themselves by Fermentation, strike in their Exaltation the olfactory Nerve; and, therefore, there must be a greater Motion of the Parts in stinking Meat than in that which smells nothing.

To this I answer, that what causes that the *Phosphorus* in Meat newly killed, is a Matter much more in Motion, and much more subtile, than that which causes the ill Smell of stinking Meat; it is a Remnant of the Spirits which did run with a prodigious Swiftness in the Body of the Animal, while alive, through all the Parts, and for want of a Matter in that Degree of Motion, there will be no *Phosphorus*; no more than if inflammable Matters were not put in a very rapid Motion of their insensible Parts, they would produce no Fire.

Here follows the Description of a *Phosphorus*, discovered by M. Homberg:—Mix exactly together one Part of Sal-Armoniac, in Powder, and two of Quick Lime, slacken in the Air; put that Mixture in a Crucible, the Third thereof must be left empty: Place that Crucible in a Furnace, and surround it with Fire to make it red hot: The Matter, which will swell in melting, must be stirred with an Iron Spatula, lest it should run over while in Fusion; it must be poured into a Copper Basin, very clean, and very dry; where it will congeal, and appear of a grey Colour.

If that Matter be stricken with a Hammer, it will be seen in an Instant all on Fire, in that Place where it has been stricken; but as it is very brittle, the Experiment cannot be repeated often; for so soon as it is reduced into Powder it produces no longer its Effect. To prevent that Accident, small Bars of Iron or Copper, heated, must be dipped in the Matter, while yet in Fusion.

in the Crucible, that they may be covered with it; one may strike on those small Bars commodiously, and make several Experiments before the Matter is separated from them; but if they are to be kept, they must be put in a warm and dry Place, for that Matter grows damp easily, and then gives no Light.

Note, That the Time in that Operation fixes the acid Part of the Sal Armoniac, and sets the volatile Salts at Liberty, which, disengaging themselves, and being forced out by the Fire, are dissipated in the Air. But there is more Appearance that the Light, which comes out of the Matter calcined, when stricken, proceeds from some volatile Corpuscles, which being concentrated in the fixt Sal Armoniac, and joined with what's left of the igneous Particles of the Lime, move with much Rapidity, when they are excited to it.

Note also, that Urine is not the only Excrement whence a burning *Phosphorus* has been extracted. M. Homberg gave, in 1710, to the Royal Academy of the Sciences at Paris, the Manner of extracting a very excellent one out of the human fecal Matter, or gross Excrements, which he has discovered after much Labour and long Application: The Method of making it is as follows:

Take four Ounces of human fecal Matter, newly voided, of a common Consistence, and as much Roch Alum in Powder; incorporate that Alum exactly with the Matter: Put the Mixture in a Skillet, and stir it with an Iron Spatula on a moderate Fire, to an entire Siccity, provided the Skillet does not grow red hot; pound and keep the Powder, which must be reduced to an Ounce and a half, or thereabouts.

Take two Drachms of that Powder; put it in a Mattrafs of a double or triple Capacity, with a Neck six or seven Inches long, and corked only with Paper; put that Mattrafs on a Crucible on the Sand, so that the Sand surrounds the whole Body thereof; place the Crucible in a Furnace six Inches deep, and eight or ten Inches of Diameter; make in that Furnace, round the Crucible, a small Fire during a Quarter of an Hour; afterwards give it half an Hour of good Fire, and lastly, an Hour of very strong Fire, to make the Matter red hot; there will come out a thick Smoak; let the Crucible grow cold; take off the Mattrafs by little and little, and cork it with a good Cork to keep it for Use.

This Powder calcined will be yellowish, grey, brown, or bluish, of a sulphurous Smell.

If some Portion of it be exposed to the Air, on Paper, it will take Fire of itself, and communicating its Flame to the Paper, be consumed with it.

To preserve it, it must remain in the Mattrafs, or in a glass Bottle well corked, in a dry and dark Place; that newly made is best, because it takes Fire sooner.

Note, That it would be very proper to dry the Fecal Matter and the Alum together, that the Mixture may be more exact; but this Drying must be done at several different Times, to hinder the Powder from growing lumpy when calcined in the Crucible, for those Lumps could hinder an exact Calcination, and the Powder resulting from it would not take Fire so easily.

This *Phosphorus* is a Kind of very porous Calx; which takes Fire the sooner, that the igneous Corpuscles, which have impregnated the Pores of its fix'd Salt, are found in it in great Quantity.

If this *Phosphorus* be exposed to the Air on a very dry Paper, it will not take Fire so soon, as on one which has its common and natural Humidity, because a small Quantity of the Humidity will give Room for the igneous Particles unfolding themselves, and direct themselves to Motion to produce Flame, which does not happen when the Paper is too dry; as Quick-Lime does not take Fire without Humidity.—Now for the *Bononian Phosphorus*.

Those who have treated of the *Bononian Stone*, have given but an imperfect Sketch of its Nature and Effects. They have spoke in a Manner, which shews plainly, that they have not well fathomed the Subject, and that they knew nothing of the greatest and most marvellous Facul-

ties of that Stone. It is true that an *Italian* having applied himself particularly to the Research, and Preparation of the *Bononian Stone*, had made great Progress in it; but it does not appear that he had opened himself to any Body on that Subject, and his Secret was buried with him.

It may be said that M. Homberg, a *German* Gentleman, so well known in the learned World, for the fine Discoveries he has made in natural Philosophy, has set to light that Stone, which was then almost forgotten; and has enriched extremely on what had appeared before with Regard to it. A Journey he made in *Italy* to find it, gave Occasion to several curious Remarks, I have taken from him, on the Places where that Stone is found, on its Nature, and on the Means of preparing it well to render it luminous.

Though the *Bononian Stone* is found in the Neighbourhood of the City of *Italy*, whence it borrows its Name; it was so little known in that City, in the latter End of the last Century, that no Body there could give any News of it, and few Persons had heard of it; which is the Reason why Travellers could learn nothing about it, and the greatest Part of them imagined that the *Bononian* was a Composition, the Secret whereof was lost.

The *Bononian Stone*, is a small grey Stone, heavy, though tender, sulphurous, shining in several Places, of the Bigness of a Walnut, but flat and uneven on its Superficy. It is always disposed so, that on the Side opposite to its Prominency, is found a Cavity; it commonly weighs an Ounce and a half, or two Ounces. Being broke, it appears in Crystals very near like the Talc of *Montmartre* near *Paris*. One of these Stones is kept, for Curiosity Sake, in the Cabinet of *Aldovrandi* at *Bologna*, where I have seen it, which weighs two Pounds and a half, and another at *Rome*, weighing five Pounds; but those large Stones are only valuable for their Rarity, for they are not the best to make the *Phosphorus*, by Reason of their Opacity; the small ones are much better, and particularly the most shining, and most full of Spots. Those with Veins of Vitriol, or Iron, are the worse. There are, sometimes, found *Bononian Stones*, cover'd superficially with a thin, white, and opaque Crust; these are very rare, but they are the best.

The *Bononian Stone* is found in several Places of *Italy*, as near the City of *Roncario*, at *Pradalbino*, at the Foot of Mount *Paterno*, which makes Part of the *Alps*, and is about a *French League* distant from *Bologna*. Father *Kircher* says, that he has found some near the Mine, of Roch-Allum, which is near *Tolfa*; but the greatest Quantity, and the best come from Mount *Paterno*. They are not easily discover'd, but after a great Shower of Rain which usher'd them into the Brooks it has formed, washes them, and causes that they are distinguished from the other Stones of the Mountain, by small Sparks they have on their Superficy. The Foot of Mount *Paterno*, where they are found is quite sterile, but the Top, where there is none, is fertile in Fruit-Trees, Vineyards, and Pastures.

The Preparation or Calcination of the *Bononian Stone*, to render its Sulphur more purified and more exalted, is made in the following Manner.

Take seven or eight *Bononian Stones*, and rasp off the Superficy till all the heterogenous Earth be entirely separated from it. Pulverize one or two of the best of those Stones, in a Brass Mortar, and sift the Powder through a very fine Searce, dip your Stones one after another into a very clear Brandy, and cover them, afterwards, all over with your Powder. Have a small earthen Furnace, the Grate whereof must be made of Brass: Heat that Furnace with two or three lighted Coals, and when those Coals are more than half consumed, fill the Furnace up to the Chops, with Cinders of an Oven, not lighted, and of the Bigness of a Walnut. Dispose gently your Stones over it, and cover them with other such Cinders, and of the same Bigness, till the Furnace be quite full; put the Top of the Furnace over it, and let the Coals burn without touching it, till it be quite reduced to Ashes. When the Furnace is cold, take off the Top, and the Hearth; you'll find on the Grate your Stones well calcined, carry gently that Grate on white Paper, and gather them, separating from them the Crust which envelopes them, and keep them in a Box

a Box with Cotton; preserve likewise the Crust, after you'll have reduced it into a fine Powder.

The Stones thus calcined, make *Phosphori*, which being exposed for a Moment to the open Light of the Day, either in a Yard or in a Street, and afterwards carry them quickly to a dark Place, they'll appear for a little Time like lighted Coals, without a sensible Heat, then they go out by Degrees. If those Stones are exposed anew to the Light, they kindle as before. They remain thus *Phosphori*, for two, three, and four Years, according as they are exposed more or less often to the Light: And when they have lost their Virtue, it may be restored by calcining them anew, and observing the same Circumstances as before, but their Light is more dim.

The Crust reduced into Powder, is likewise a very fine, and very luminous *Phosphorus*, after it has been exposed to the Light. Several different luminous Figures can be made of that Powder, by drawing first those Figures on Paper or Wood, with Whites of Eggs, and spreading over them, while the Lines are yet humid, the luminous Powder that it may stick every where. Those Figures must be left, afterwards, to dry in the Shade. When dry, they are put in a Frame, and covered with a Glass, that they may be touched no more. When it is wanted to render those Figures luminous, they must be exposed thus framed, and covered with the Glass, to the Light, and carried afterwards to a dark Place.

A luminous Crystal can also be made, in filling exactly with that Powder, a small Crystal-Bottle, and corking it well, so that it may be open'd no more. It will produce an Effect like that of the Stones, and its Light will last longer, but will be more dim.

Note, That the first who took a Fancy to calcine the *Bononian Stone* was a Shoemaker, called *Vincenzo Casuarolo*, Fool enough to neglect his Profession, to turn Alchymist. That Man taking a Walk, at the Foot of *Mount-Paterno*, gather'd some of those Stones, in which he imagined he could find Silver, because they glitter like Silver, and are very heavy; but instead of finding Silver, or any other Metal in calcining them, he found by a marvellous Accident the Phænomenon we see in them. *Poterius*, *Montalbus*, *Maginus*, *Licetus Menzelus*, and several other Authors have wrote of this Stone, and given the Manner of calcining it, but their Descriptions are of no Use, because one cannot succeed in following what they have said.

As the *Bononian Stone* is very tender, its Superficy is easily carried off with a Rasp; if any Earth remains, there remain Spots after Calcination, where there appears no Light. If one was to calcine the Stone without wrapping it in the Powder of a like Stone, it would produce, after Calcination, but very few Sparks of a very weak Light; therefore it is necessary to observe exactly my Description. What gave Occasion to *M. Homberg* to prepare it in this Manner, entirely unknown before his Time, is, that on a Journey, carrying some of those Stones along with him, by rubbing against one another, they formed a Dust, which stuck to them in Part; and as he calcined them in that Condition, without separating the Dust, he found, after Calcination, that the Places where that Dust had stuck, were much more luminous than the other.

The Powder must be subtle to stick to the Stone, and to take better the Light after Calcination: For the Light fastening only on the Superficy, the subtle Powder will have much more of it than a coarser, which has less Surfaces. — This Powder must be made of the most fixed Stones, the cleanest, and the most transparent; because the luminous Brightness of the calcined Stone, proceeds entirely from the Goodness of the Powder which has covered them. Bad, and opaque *Bononian Stones* have been wrapped in very good Powder, and those Stones, have well answered the Purpose. On the contrary, very fine and transparent ones have been cover'd with Powder made of bad Stones, and those fine Stones have produced no more Effect, than if they had been calcined, without being covered with Powder, *i. e.* that they were scarce luminous.

The Powder must be made in a Brass Mortar,

otherwise the Stone cover'd with it, would not become luminous, though ever so exactly calcined; some have been pounded in Mortars of Iron, Marble, Porphiry, or Crystal; and the Operation has always miscarried; that same Powder has been pounded over again, in a Brass Mortar, and it has been used on the same Stones, which have appear'd a little luminous after Calcination; but the Powder which has been made in an Iron-Mortar, was but very little corrected in the Brass one; and gave scarce any Light to the Stone wrapped in it. There must be in Iron something prejudicial to that Effect, and, on the contrary, Brass agrees with the Nature of the Stone. As to Marble, Porphiry, and Crystal, they want certainly what the Brass has to suit the Stone; but, however, those Matters do not communicate so hurtful Impressions to it, as Iron does. The bad Quality of Iron, with that Respect, proceeds, perhaps, from that the vitriolick acid of that Metal, uniting with the Sulphur of the Stone, which is much exalted, fixes it so that it hinders the Light from lighting it, to make it light in its Turn.

One may use common Water instead of Brandy, to wet the Stone, provided the Water be very clear, and leaves no Sediment; some have used even acid Spirits, which have succeeded as well as Brandy; it is wetted to make the Powder stick to it the better, and form a Kind of Crust upon it.

The Furnace used for the Calcination of the *Bononian Stone*, must be made of the same Matter all other portative Furnaces are made of: It must be round, about a Foot high, without the *Dome*, and very near half a Foot Diameter. It must have two Registers to manage the Fire: It must be cover'd with a small *Dome*, to make the Fire reverberate on the Matter. The Grate must be of Brass, for if of Iron, it would perhaps as much prejudice the Stone, as an Iron Mortar does; and if of Earth, the Fire could not be violent enough, besides that Brass helps towards rendering the Stone luminous. Copper does not produce so good an Effect, because, perhaps, it contains no *Calaminaris*; for it may happen, that that Stone may communicate some Vapours to the *Bononian Stone* in the Calcination, and open the Pores thereof to render its Sulphur more susceptible of the Impression of Light. It is proper the little Furnace should be divided in two Parts, that when the Fire is extinguished, the upper Part thereof may be easily taken off, to gather the calcined Stone.

As the first Coal put in the Furnace serves only to heat it, it suffices that it be common Coal; but if the same Coal was used during the Calcination, that Coal, in cracking, shaking the Stones might chance to let fall the Powder which is round them; the Cinders of Bakers is the most commodious; and those Cinders must not be bigger than Walnuts, lest they should make a too violent Fire; neither are they to be too small, for Fear they should smother the Fire, and hinder the Calcination from being perfect.

The Stone retains the Colour of the Fire which has been given to it; therefore when the Fire can be made white, the Light of the Stone appears whitish; if violet, the Light will be violet; if green, the Stone will have a green Light; if yellow, the Stone will give a yellow Light; but when one wants to excite those Colours, Care must be taken not to use fixed Matters, they must be entirely volatile, lest they should leave a Scurf on the Stone, which would hinder its Light.

When he is contented with calcining the Stone as I have described it, without adding any Artifice to the Fire; it represents always a red hot Coal, unless it contains some Part of the Metal or Mineral. If it partakes of Copper, it gives a greenish or bluish Colour; if of Iron, it is opaque, and worth nothing; if of *Sal Armoniac*, the Light is whitish: The Stones covered naturally with the white and thin Crust abovementioned, take a blue or green Light.

If the Stones have a yellowish Colour, when taken out of the Furnace, they are good to receive Light, but when they have grey, white, or black Spots, they do not shine.

The Furnace must be quite cold before the Stones are taken out, for if it was yet hot, they would fall into Pieces.

The Powder fasten'd round the Stone by Means of the Brandy, dries up, during the Calcination, into a Crust; and often little Bits thereof fall from it into the Ashes. That Accident is prejudicial to the Operation, for the Stone is but very little luminous in those Places which the Powder has left off.

If by some Accident the Stones were not become luminous after the Calcination, the Operation should be renewed, and by observing the same Circumstances, they could be made good.

The Stones calcined anew, after they have served two, three, or four Years, though they re-assume a whitish Light, are never so luminous as after the first Calcination.

After the first Calcination, the Stones quit easily the Powder or small Crust formed on them; but after they have been calcined a second Time, it sticks faster; the Reason is, that after the first Calcination, there is much more Sulphur on the Superficy of the Stone, than there was after the second, and that Sulphur that is oily, hinders the Crust from fastening to the Stone.

The *Bononian Stone* acquires by Calcination a sulphurous Smell, very much like that proceeding from the *Phosphorus* made with Urine or Lye, drawn from a Mixture of Lime and Orpiment, but much weaker.

If the *Bononian Stone* calcined, be left sometimes on a Piece of Brass, polished on its Superficy, the Brass will take the Colour of Silver, not only in the Place touched by the Stone, but all round, which proceeds from the Penetration made in the Brass by the saline Sulphur of the Stone, which having changed the Disposition of the exterior Parts of the Metal, there happens to our Sight a Reflection of Light different from that, which happen'd when we look on the Brass.

The calcined Stone must be left to cool before it is exposed to the Light: For it does not become so luminous while hot, as when it is cold. It does not suffice, to render it luminous, to make it receive the Light in a close Place, as in a Room, Hall, &c. but it is necessary to expose it with the Hand, out at a Window, in the Street, in a Yard, or any other such Place, that the Rays of Light may fall perpendicularly upon it; but it must not be immediately to the Sun, for the Light it would take then would not be so beautiful, and the Sun, besides, would wear it out too soon by its Heat, in carrying off too many of the Particles of the Sulphur which are necessary to it. It takes a finer Light at Sun's Setting, than when it is much above the Horizon, but it takes none, after the Sun is set, tho' it be Day-light yet. During the thickest Clouds and darkest Tempests, provided the Sun be on the Horizon, it becomes more luminous than in a clear Sky; but never in the Night; and very little by the Moon's Light; and still less by that of a Flambeau. The Air avails it nothing; for if after it has been pumped out of a Bottle, the Stone is shut in it close with a Glass-Cork, and Sealing-Wax, and that Bottle exposed to the Light, the Stone will receive as much of it, though it be in the Vacuum, as if it was out of the Bottle; but as it is cover'd with Glass or Crystal, its Fire does not appear so brisk, because the Rays darted from it, being a little broken in passing thro' those transparent Walls, do not strike the Retina with so much Force, as when it is naked. The Differences between this *Phosphorus*, and that made of Urine, is, that this wants Light, and the other wants but Air.

To be in a Condition to consider well the luminous Brightness of the *Bononian Stone*, the Place must be darken'd, and one must remain sometimes in the Obscurity, before he looks at it; and this must be observed particularly in a clear Day; for in a dark one, when it rains, there needs no such Precaution; for our Eyes being not then used to a great Light, are more capable to discern that of the Stone.

The *Bononian Stone*, is only luminous in its Surface, for if it be broken it shews no Light inside; it is true, that if that Inside was calcined, it would ap-

pear luminous like the rest on its Superficy. The Powder which has served to cover the Stones during the Calcination being exposed to the Light, and afterwards carried in a dark Place; appears all on Fire on its Surface; but if it be stirred, the Powder which was underneath is opake; if it be spread, and exposed anew to the Light, all that is seen of it appears luminous.

Having thus far related the marvellous Effects of the *Bononian Stone*; it will not be improper, next, to reason on them, and to explain, as clearly as possible, how that Stone is impregnated with the Light; which to do with some Order, we should consider two Things, viz. what Light is, and what Disposition the Stone must have to receive it; but as I have already treated the first in the *Opticks*, nothing else remains but to explain the last.

The *Bononian Stone*, as I have observed already, is full of Sulphur, but that Sulphur before Calcination is so well united with the other Principles which compose the Stone, that it does not appear, and this is no more luminous than the other Stones. The Fire opening its Pores, causes thereby the Exaltation of the Sulphur, the greatest Part whereof is lost in the Air; though there remains still much of it, stopped by the Powder the Stone is cover'd with. If it was calcined less than I have prescribed, its Pores would not be sufficiently open'd, nor its Sulphur enough in Motion; it may even happen, that a Part of the coarse Sulphur which is dissipated first, would obstruct the Effect of the Stone was it to remain in it. If, on the contrary, it was calcined longer, there would be a too copious Evaporation of the Sulphur, by the Action of the Fire, and the Stone would produce little or no Effect, which happens when it is not covered with the Powder of another Stone; for the Sulphur, then, coming out with too great Facility, is almost entirely lost, and the Stones take but very little Light, whereas that Powder not only stops Part of the volatilized Sulphur, but furnishes some itself. The sulphurous Smell the Stone has after Calcination, shews very well that there is much Sulphur left in it; it is evidenced then, by all Experiments, that the calcined Stone which takes Light, contains a very exalted Sulphur, the insensible Parts whereof fly to the Surface.

This pre-supposed as a Thing, which to me appears unquestionable, I say, that the *Bononian Stone* calcined, becomes luminous when exposed to Day-light, because the Light, which is a Fire, lights the superficial Sulphur, and makes it appear Burning-hot, in the same Manner the Fire lights a Coal. Let's see if I'll account for all the Experiments, and if I'll be capable to solve all the Difficulties.

The *Bononian Stone* in the Calcination, has been reduced into a Kind of Calx, and there is much Appearance, that in the Room of the Sulphurs which have been exalted from it, have been introduced igneous Particles, which have entangled themselves in the ramous Particles of those left. Those igneous Particles can contribute much towards rendering the Sulphur of the Stone susceptible of that Fire of Light. For though they be shut in the Pores of the Matter as in little Cells, they notwithstanding make some Effort by their Motion to fall out; and they volatilize and divide the Parts of that Sulphur so subtilly, that the weakest Fire, which is that of the Light, weaken'd by Clouds, is capable to light it.

When the Stone is on Fire, it does not appear luminous in Day-light, because our Eyes being drenched with a greater Light, is incapable of perceiving that little Fire, very near as we do not distinguish the Light of the Moon while the Sun is on our Horizon; but when the Place where the Experiment is to be made, is darken'd, the Light of the Day striking the Eyes no longer, the Fire of the Stone is seen in all its Brightness, that Fire lasts about half a Quarter of an Hour, and no longer, for that Fire, weaken'd by Degrees, is extinguished at last, because the lighted Particles of the Sulphur being environ'd with a great Quantity of terrestrial Matter, have not Strength enough to continue their Motion of the Fire, and must be lighted again at the Light, if one wants they should burn.

But there occurs here a Difficulty, which is to know why the Stone appears less luminous, when exposed yet hot to the Light, than when it is quite cold: For it

seems that its Sulphurs being pushed with more Rapidity to the Circumference, while it remains hot, than when it is grown cold, it should likewise take more Fire and appear more luminous.

This Objection may be answered in two Manners; the first, that it may happen that the Sulphur has been more inflamed while the Stone remained hot, than when it became cold; but that the Sulphur burning with too much Impetuosity, its Fire has been rarified in such a Manner, that it is not so visible as when it's fixed. Just as lighted Coals have much more Colour, than the Flame of Wood which is a Fire much more exalted.

The second Answer is, that as more Sulphur rises to the Surface of the Stone while yet hot, than when it is cold, as that Sulphur can usher along with it a great Quantity of coarse Particles, the Light which is a very subtile Fire, has not the Strength to inflame it so easily; whereas when the Stone is cold, the exalted Sulphur which flies to its Superficy, being much more subtile, because the coarser Particles thereof are precipitated in the Stone, has much more Proportion with the Strength of the Light, and therefore is easier inflamed.

It may be objected, that there is a great Number of Sulphurs, and sulphurous Matters, which appear to us much exalted and rarified, as the Spirit of Wine, Camphir, &c. which are not inflamed at the Light.

To this I answer, that as those Sulphurs have not so much Subtlety nor Delicacy in their Parts, as that of the *Bononian Stone*; they want a Fire much more material than Light, to put them into Motion and inflame them.

The Fire which appears on the *Bononian Stone*, is not capable to burn or to heat the Skin when applied to it, because its being too delicate, it has not Strength enough to hurt or shake the Nerves so as to make Impression on them.

When the Stone is exposed to the Sun, it not only wears it out by a too quick Dissipation of its Sulphur, but hinders it likewise from appearing so luminous, for the same Reasons I have mentioned, in speaking of the Heat of that Stone, at its coming out of the Fire. There is the same Appearance that the Evening Light, a little before the Sun-setting, or that of a rainy, or dark Day, is more proportioned to the Sulphur of the Stone, than a very clear or fair Day, since it appears with more Lustre at that Time. There wants but very little Fire to light a very small Quantity of sulphurous Matter; a too large Fire swallows it, and hinders it from being seen to burn. The Sulphur of the Stone being much exalted, a weak Fire suffices to light it. It must be observed notwithstanding, that a Light which is too far distant from the Sun, is a too weak Fire to light well that Sulphur, for when the Stone is exposed to the Light which remains after Sun-set, or to Moon-light, or to that of a Flambeau, it becomes but very little luminous.

It is very surprizing, that that Stone be capable to receive the Light for four Years successively, and even longer, which makes me believe that the same sulphurous Particles which appear in Fire can be extinguished, and lighted again a vast Number of Times, before they are dissipated, though we must believe that some Part thereof is consumed, every Time the Stone is rendered luminous; but it may happen likewise, that that small Fire rarifies and exalts other Fire from the Inside of the Stone, which takes the Place of that which is lost.

The Delicacy of the sulphurous Particles which fly to the Superficy of the Stone, must be very great, since by pulverizing only the Powder it is covered with in an Iron Mortar, the Impression that Powder can take then of the Metal, let it be ever so little, is capable to hinder the Stone from receiving Light.

The Stone takes a Light of the same Colour of the Fire which has been given to it in the Calcination, because its Sulphur having tinged itself with that Colour, when lighted by the Light it must produce one like it. The Sulphur takes likewise the Colour of any metallick Impression it receives from the Stone, or makes a bluish, greenish, or whitish Light, according to the Nature or Colour of those metallick Matters, for the same Reason.

After the most inflammable sulphurous Particles of the Stone have been entirely consumed by the Fire of

the Light, which happens in the Space of several Years, as already observed; it is calcined anew, to exalt and rarify the Sulphur left in it, and render it capable of being inflamed by the Light. But as it is neither so subtile nor so susceptible of Motion as that of the first Calcination, its Fire is neither so quick nor so bright.

The Powder scraped from the Stone after Calcination, being spread on Paper and exposed to Light, takes much more Fire from it in Proportion than the Stone itself, because the outward Surfaces of the Parts of the Powder have been all lighted, and take up much more Room than that of the Stone.

It is often objected, that if it is true that the Light of the *Bononian Stone* calcined, proceeds from that its Sulphur has been lighted by the Fire of the Light, Air was necessary as well to form that Fire as to keep it up; which notwithstanding, we see that the Stone and the Powder calcined, take and maintain their Light *in vacuo*.

I answer, that the sulphurous Particles of the Stone being supposed of a Delicacy proportioned to the Fire of the Light, there wants no Air either to light them or to keep them on Fire; for if Light passes and maintains itself *in vacuo*, it can likewise light a very subtile Sulphur *in vacuo*, and keep it on Fire: But if this Answer does not seem satisfactory to those that make the Objection, and they are resolved on having Air to light the *Bononian Stone*, we'll find as much of it as is necessary, in what is called *Vacuum*, since the Air cannot be entirely exhausted out of a Glass Vessel, a small Quantity thereof remaining still in it, and that Quantity must suffice to light so subtile a Sulphur.

But we ought not to consider that Fire as a common one, which is fed and kept up by coarse Matters, and can neither be made nor subsist without Air; because it is the Air which excites and maintains the Motion of the Parts of the common combustible Matter; but our Fire of Light is of a much greater Delicacy, its being formed and kept up by the Motion of a very subtile Matter, on which the Air can make no Impression, it is a concentrated Light, which the most impetuous Winds could neither light nor extinguish; and it may be said, that that Fire has no more need of Light to burn, than Light has to shine.

There are several very considerable Differences between the Phosphorus extracted from Urine, and that of the *Bononian Stone*; for the former becomes luminous Day and Night, provided it be exposed to the Air; but if it be deprived of Air it cannot light; the last receives Light but in Day-time in the Air, or without Air, but never in the Night; which shews plainly that those two Sorts of *Phosphori* are lighted in a different Manner.—The *Urinous Phosphorus*, is capable to light in all its Parts; the *Bononian Stone* lights but on its Superficy. The Light of the *Urinous Phosphorus* is always of the same Colour; that of the *Bononian Stone* appears often of different Colours, and always brighter than the other: The *Urinous Phosphorus* spreads at Pleasure; for we may form Letters and other Figures with it, by rubbing it on Paper or elsewhere, which cannot be done with the *Bononian Stone*; the *Urinous Phosphorus* burns the Finger, when it is held some Time, and sets Fire to several combustible Matters. The Fire of the *Bononian Stone* is not in the least sensible: The *Urinous Phosphorus* cannot be well preserved when extinguished, but in Water; it always smoaks when it is out of it, and is destroyed in a very short Time; the *Bononian Stone* is kept dry in a Box, and emits no sensible Smoak: The *Urinous Phosphorus* dissolves in an oily Liquor, which the *Bononian Stone* does not: The *Urinous Phosphorus* produces more Light hot, than cold; the *Bononian Stone* on the contrary takes Light better when it is cold, than when it is hot; for all which Differences I'll account in the following Manner.

1. The *Urinous Phosphorus* cannot be set on Fire by the Light alone; because its Sulphur is too coarse to be lighted by a Fire of so subtile a Nature: There wants a Pair of Bellows, such as the Air to put into Motion the Parts of the *Phosphorus* which are saline and sulphurous; that rubbing with much Rapidity against one another they may take Fire, as it happens when a Seal is rubbed hard against a Flint; therefore there should be an

the Parts of the Matter, a very great Disposition to Motion. — As for the *Bononian Stone*, its Sulphur is so much exalted, and so well divested of all coarse Particles, that it needs, to take Fire, no other Motion, than that it borrows from the Light; that Sulphur does not take Fire in the Night, because there is then nothing that can light it; all the Air in the World is not capable to move its Parts with Rapidity enough to make them take Fire; they are too subtle to receive the Impressions thereof.

2. The *Urinous Phosphorus* lights in all its Parts, and the *Bononian Stone* lights only on its Superficy, because all the Parts of the *Urinous Phosphorus* are susceptible of the Motion which sets them on Fire, whereas in the *Bononian Stone* none but the superficial sulphurous Particles can be set on Fire, because those have been exalted enough, and put enough in Motion in the Calcination.

3. The Light of the *Urinous Phosphorus* is always of the same Colour, because it proceeds always from a Fire produced of a Matter of the same Nature; but the *Bononian Stones* give their Light of different Colours, because they partake of different Marcasites, which in the Calcination acquire Colours according to their Species, and communicate them to the Fire they make appear. The Light of the *Bononian Stone* is brighter than that of the *Urinous Phosphorus*, because its Sulphur is purer.

4. The *Urinous Phosphorus* spreads, because it is almost all Sulphur, there being but very little Salt and Tartar in it; the Sulphur being a Substance which spreads much more than any other. The *Bononian Stone* contains Sulphur, but it is environ'd with so much Earth, that it can neither spread nor stick to Paper.

5. The *Urinous Phosphorus* burns the Fingers, and the *Bononian Stone* gives no Heat, because the Fire of the *Urinous Phosphorus* is made and kept by a Matter coarse enough to make the Impression of Heat, in shaking hard the nervous Fibres, whereas that of the *Bononian Stone* being only produced by Light, and kept by a very subtle Sulphur, has not Strength enough to shake the Nerves, or to render its Heat sensible to the Part that touches it. It is for the same Reason that the *Urinous Phosphorus* sets combustible Matters on Fire; and the *Bononian Stone* has no such Faculty; for the great Rapidity of Motion excited in the insensible Parts of the *Urinous Phosphorus*, in rubbing it with a Point of a Knife on the Matter to be set on Fire, or in having it wrapped with some Heat, is capable to excite in it a Fire much more violent than is that of the Light it produced before, and capable to light that Matter. But it must be observed, that when we want to set on Fire, with that *Phosphorus*, Paper, or some other white and polished Matter, it must be a little rasped previously to it, to raise a kind of Down on the Superficy, which may easily take Fire; for when this Circumstance is neglected, though the *Phosphorus* lights, it does not communicate its Fire to the Paper; and the Reason is, that the insensible Parts which compose what we call White, being all much more disposed to reflect Light than any others, the Fire of the *Phosphorus* cannot fasten to it, unless a Kind of Match be given to it by scraping the Paper. There is not the same Difficulty in written Paper, nor in any other black combustible Matter, tho' polished, the Fire of the *Phosphorus* fastening to it easily, because as Black does not reflect the Light, it penetrates it easily. Very near the same Thing happens, when white and written Paper are exposed to the Sun near a concave Mirrour; for the written Paper takes Fire much easier than the white: As for the *Bononian Stone*, it can communicate its Fire to nothing, because it is too subtle, and passes and repasses as Light does, through combustible Matters without lighting them, because it has no Strength to shake enough their insensible Parts.

6. The *Urinous Phosphorus* is preserved in Water, and the *Bononian Stone* is kept dry; the Reason is, that the *Urinous Phosphorus* being almost all Sulphur, Water condenses its Parts, as it does those of other Sulphurs, and thereby hinders the Air from dissipating them, whereas the sulphurous Particles of the *Bononian Stone* being environed with much Earth which stops them, they want no Water for that Purpose; it suffices to keep that Stone with Cotton in a Box. There is much

Appearance, likewise, than the sulphurous Particles flying perpetually to the Superficy of the Stone, few of them are dissipated; but that the greatest Part fall back, and re-enter the Pores, to produce always Light, till all the Sulphur be evaporated; but a greater Quantity thereof is dissipated, while it is lighted, than when it is extinguished; therefore it lasts much less when it is often lighted, than when but seldom exposed to the Light. The *Bononian Stone* takes Light as well when it is wet, as when it is dry; the aqueous Humidity being incapable to hinder its Sulphur from lighting; because it cannot mix with it, but slides over it as it does over other Sulphurs. But if it was left to soak in Water, like the *urinous Phosphorus*, its terrestrial Parts then growing stiff like a Calx, could not wrap up its sulphurous Parts, and confound them so that they could not receive the Light.

7. The *Urinous Phosphorus* dissolves in Oil, and the *Bononian Stone*, not: The Reason is, that the *Urinous Phosphorus* being properly a Sulphur, or a coagulated Oil, oily Liquors are dissolvent very agreeable to its Nature, because they mix easily with its fatty and ramous Parts, and rarify them. But the *Bononian Stone* containing much more Earth than Sulphur, is not dissolved in Oil, but remains in it as luminous as it was before: If notwithstanding it was left a long Time to sleep in an oily Liquor, part of its Sulphur would be thereby loosen'd, and the Stone become less luminous, though not the Liquor, either because it would contain too little of the Sulphur of the Stone, or because the luminous Sulphur being loosen'd, would be confounded with the coarse and opaque Sulphur.

8. The *Urinous Phosphorus* lights better, while hot, than when cold; on the contrary, the *Bononian Stone* becomes more luminous when it is cold, than when hot; the Reason is, that the Parts of the *Urinous Phosphorus* acquire by Heat a more impetuous Motion, and consequently are more capable then to make Fire, than when they have not been heated; but the Sulphur of the *Bononian Stone* being very subtle, and freed from the coarse Matter, is rarified in such a Manner, and so soon dissipated while hot, that it does not appear so much as when it is cold.

There is another Kind of *Phosphorus*, which is that called the *Hermetick Phosphorus of Balduinus*; its being a Mixture of Chalk, and of the Acids of the Aqua-fortis, which produces Light.

This *Phosphorus* is made in the following Manner: Take what Quantity you please of Aqua-fortis, for Instance, a Pound, pour it into a large Cucurbite, and throw into it a Spoonful of white Chalk, well dried, and pulverized, there will ensue a strong Ebullition; the Matter being dissolved, throw in again the same Quantity, continuing thus till there happens no more Effervescence: Leave the Liquor to settle, and then pour it by Inclination into a Stone Pan; place it on the Sand; making all the Humidity to evaporate at a very slow Fire; there will remain a saline Matter at the Bottom.

Put that Salt in a Coppel or in an earthen Dish, not glazed; and place the Vessel over a very slow Fire, the Matter as it grows hot, will swell: Continue that slow Fire for about an Hour, or till the Matter be sunk a little; cover it then with a Lid with three or four Holes; increase the Fire by Degrees, till it be strong enough to melt the Matter; and when melted, you must wait for a yellowish Vapour, which will come out at the Holes: As soon as that Vapour shall appear, take your Vessel off the Fire; and having cover'd it with an earthen Lid without Holes, in the Room of that with Holes, leave it to cool, you'll find round your Vessel a yellowish Matter, sometimes a Finger thick, which is the *Phosphorus*, and which is not to be broke, but kept as it is in a dark and close Place.

To render this *Phosphorus* luminous, it must be exposed for a Moment to the Light, then carried to a dark Place.

Note, That the Cucurbite must be large, and the Chalk thrown by Degrees into it, otherwise the Matter would run over; the Chalk is entirely dissolved in Aqua fortis, and there is some thrown into it, till there happens no more Ebullition; for it is a Mark then, that the acid Points have made all the Effort they could

could in the Rarefaction, and that being entangled, or sheathed in the Particles of the Matter they suspend, they are no longer capable to dissolve any more of it. When the Aqua-fortis is good, it dissolves very near its Weight of Chalk, the Dissolution is yellow. The Humidity which is made to evaporate, is the most phlegmatick Part of the Aqua-fortis, and the Acids being incorporated with the Chalk, make a Kind of very acrimonious Salt; which Salt could be very easily dissolved in the Air, into a Liquor. It must be very dry when it is put in the Coppel, that the Operation be sooner perfected. The Vessel is cover'd with a Lid, to hasten the Fusion of the Matter; but it must be pierced, to give Vent to the Vapours which arise from it; and that it may be seen when they are yellow to take the Vessel off the Fire; for those yellow Vapours make the Light of the *Phosphorus*. The Matter must necessarily be kept in the Coppel, or in the Dish, in the same Disposition it is found after Calcina-

tion; for though nothing else be luminous, but the yellow Border, it cannot be separated from the Vessel, nor from a terrestrial and useless Matter, which is at the Bottom, without destroying it: The Reason is, that the Light of that *Phosphorus* proceeds from its Surface only; therefore in separating the yellow Border, it would be very difficult to hinder the superficial Top from being confounded with the Matter underneath, which is not luminous. To preserve better this *Phosphorus*, it may be shut in a Box, with a Glass Lid, to prevent its Sulphur being too much dissipated: It takes Light through the Glass, in the same Manner the *Bononian Stone* does, and for the same Reason; but its Fire is not so bright, and remains luminous but fifteen Days, or thereabout; after which it is extinguished for ever. It is kept in a dark Place, that its Particles being more condensed, may be better kept.

ORDERS.

OR D E R, in the Sense I take it here, is a Society, or Congregation of Persons, assembled together under a Superior, to live in Unanimity and Concord, obey the same *Orders*, and follow the same Rule.

This was the Appellation, almost from the very Infancy of Christianity, till now, of those truly apostolical Men, who taking the Counsels of the Gospel in the strictest Sense, have abandon'd the World and its Pomps, to follow Christ, and to lead in a mortal Body, an angelical Life; at least this was the Motive of the holy Institutors of the first *Religious Orders* established in the Christian Church.

The same was attributed afterwards to the illustrious Societies, of those valiant Knights, who exposed their Lives, and fought bravely in those Holy Wars, undertaken for the Recovery of those Places, which our blessed Saviour had sanctified by his sacred Presence, during his mortal Life; and which has been extended to several others, which have been established since on the same Model.

Whence those two Sorts of *Orders* have been distinguished since from one another, by the Addition of two characteristical Words, viz. *Religious* and *Military*: Therefore as the *Military Orders* are inferior with Respect to Time to the *Religious* ones, since those have been instituted on the Model of these; I think proper to give first a concise Account of the Beginning, Progress, &c. of all the *Religious Orders*, and of every one of them in particular; and pass afterwards to that of the *Military* ones.

It is the common Sentiment of the Christian Church, supported by undeniable Authorities, that the Persecution of the Emperor *Decius*, in 254; was the first Occasion of the Institution of the *Religious Orders*.

In effect, a great Number of Christians not finding themselves strong enough to suffer the cruel Torments which Hell itself had invented then to destroy the Empire of Christ, which his Disciples were endeavouring to establish on the Ruins of that of the Devil, fled to hide themselves in the most frightful and unfrequented Solitudes, where they soon found themselves entirely deprived of all that was necessary for the Support of their Life, and exposed to the Injuries of the Air, to the Inclemency of the Seasons, and to the Rage and Fury of the most wild, and most voracious Beasts. *Paul* and *Antony*, whose Lives have been wrote by *St. Jerome*, were of that Number; the first is consider'd as the Founder of the *Anachoretical*, and the other of the *Cenobitick* Life; though *M. Fleury*, in his Ecclesiastical History, refers the Institution of *Cenobites* to the Time of the Apostles, and makes it a Kind of Imitation of the ordinary Life of the Faithful of *Jerusalem*.

Other Authors consider the Prophet *Elias* and *John the Baptist*, as the first Institutors of a religious retired Life.

Philo the *Pythagorician* says, according to *Sozomene*,

that the most excellent Men among the *Jews* met in his Time on a Hill, near the Lake *Maræotis*, to follow that Kind of Life; he describes their Buildings and Exercises, and represents them such as those of the Christian Monks who came afterwards. He says, that so soon as they begin to apply themselves to the Study of the sacred Wisdom, they leave their Estate to their Relations, renounce the World, and Marriage, and retire into Gardens out of the Cities; that they have Monasteries and Chapels for Divine Service, where they sing Psalms and Hymns; that they never eat till after Sun-set; some of them eating but once in three Days, and others seldomer: That at certain Days they lay on the Ground, and eat nothing but Bread, Salt, and Hyssop, and drink nothing but Water, &c.

But without going so far back for the Origin of the Institution of a monastick Life, I'll follow the common Opinion of the Christian Church, which is, that *St. Paul* was the first *Anachorete*, and the Inventor of that sublime Philosophy, which his Disciples have endeavoured to follow since; though *Sozomene* attributes that Institution to *St. Antony*, born in a Borough of Egypt, called *Cana*, near *Heraclea*. Having lost his Father and Mother, while he was yet very young, he abandon'd their Succession to his Countrymen, and having sold his Goods, he distributed the Price thereof to the Poor, in the Belief, that a true Philosopher must not content himself with renouncing his Estate, without making a good Use of it. He contracted a particular Friendship with all those of his Time, he knew the most eminent in Piety, and endeavoured to imitate them. Knowing very well, that the Practice of Virtue is bitter to Beginners, and becomes sweet to those who have made some Progress in it; he applied himself to it in such a Manner, that he was consider'd afterwards, as a perfect Model of all the Christian Virtues; the Reputation whereof, gain'd him soon a great Number of Disciples; among whom some rank *St. Paul* himself.

It is true, that the Life of *St. Antony's* Disciples, cannot be called *Cenobitick*, if we understand by *Cenobites*, living in Community, under the same Roof, in the same Convent or Monastery: But if we understand by it a Society of Persons following the same Rules of Life, and under the Direction of the same Superior; *St. Antony* was certainly the Institutor or Founder of a *Cenobitick* Life; since, according to *St. Jerome*, who has wrote his Life, he was the Director of a vast Number of Monks, who were all under his Discipline, whom he visited continually, and by whom he was always accompanied; he being styled, besides, an Abbot in the *Roman Martyrology*. Which proves manifestly that the monastick Life is not of a modern Institution; as the vicious Monks and Friars, who have endeavour'd to hide their criminal and debauched Life under that false Pretence, have made the Vulgar believe. Let's hear what *Sozomene* says, l. 12. l. 1. *Eccles. Hist.* to confirm my Sentiment.

Those (says he) who embraced at that Time, the monastick Life, did a great deal of Honour to the Church, and confirmed the Truth of her Doctrine, by the Purity of their Manners. The Philosophy they profess, is one of the richest Gifts, Heaven has ever bestowed on Earth. They neglect the mathematical Demonstrations, and the Arguments of Logick, because they are persuaded, that they steal much Time, and are of no Service to a godly Life; to apply themselves entirely to a natural Prudence, which roots out Vice, or at least diminishes it. They do not rank among Goods, what keeps a Sort of Ballance between Vice and Virtue, and believe that it is to be wicked, to abstain from Evil, without doing Good. They search Virtue for itself, and not for human Praise. They fight continually their Passions, without any Regard to the Necessities of Nature, or to the Infirmities of the Body. Being supported by the omnipotent Strength of the Creator, they look upon him, adore him Day and Night, and address continually their Prayers to him. Making his true Worship to consist in the Purity of their Heart, and in the Holiness of their Life; they care very little for external Purifications. They do not believe that there are any true Spots, but those which proceed from Sin, therefore they do not care to wash those of the Body. As they are above all Accidents and Dangers, which may happen in the Course of their Life; Inconstancy, which reigns with so much Power in the World, and Necessity, which exercises in it a tyrannical Empire, never make them change Sentiments, they are never provoked at the Injuries done to them, and never thirst after Revenge. They do not lose Courage when attacked by Malady, or oppress'd by Want. They rather glory in it, and suffer with Patience. They use themselves, during their whole Life, to be contented with little; and thereby approach the Independency of God as much as it is possible for the human Infirmary. They do not endeavour to acquire Estates, because they only consider this Life as a Passage, and make no other Provisions but those which an indispensable Necessity requires. They value that Manner of Life which is the most simple, and think of nothing but of the eternal Felicity promised to them. They only breathe Piety, and avoid in their Discourse the Impurities they have banished from their Actions. They use their Body to be contented with little, and conquer Intemperance by Temperance, Injustice by Justice, and Falshood by Truth. They live in Peace and Harmony with all those who frequent them. They take Care of their Friends and of Foreigners. They give Part of what they have to those in Want. They comfort those in Affliction, and do not afflict those in Mirth. As they are serious in all Things, and refer all their Actions to the sovereign Good, they instruct by wise and judicious Remonstrances, where there is neither Flattery nor Bitterness, and where those who hear them find salutary Remedies for the Maladies of their Souls. They converse together with Honour and Respect, without Contestation, Raillery or Wrath, being wholly governed by Reason. They curb all contrary Motions, and command the Passions of the Mind and of the Body.

This is the concise Sketch of the Life of the first Monks, given by an Author, who cannot be suspected of Falshood, or of having been imposed upon by false Memoirs; since he lived in the Time he speaks of, and had been an Eye-witness to what he says; since he had been converted from Paganism to Christianity, by some of those Monks, whose Life he paints with so divinely beautiful Colours. These are the Men, whom Calvin, &c. and his Followers, are pleased to call the Locusts of the Abyss. Tho' I must confess ingenuously, that the Monks of our Time have much degenerated from those above-mention'd; and their Life and Conduct, is a tacit Condemnation of that of their holy Founders, or rather that of their Founders is a sure Condemnation of theirs; as we'll see in the Sequel of this historical Account of all the different Religious Orders.

Note, That in those fortunate Days, the Name *Monk* was given to all those indifferently who retired from the

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World, to give themselves up wholly to God; tho' they were distinguished into several Classes, viz. of *Anachorets* or *Solitaries*, *Canobites*, and *Sarobites*.

The *Anachorets* or *Solitaries*, were those who lived alone, in Places remote from all Towns, or Habitations of Men, as do still those few we call Hermits, though that Sort of Life is grown much obsolete, especially in the West, where most of those who follow it, are despised as Strollers and Vagabonds.

The *Canobites*, as already observed, were those who lived in Community with several others, in the same House, and under the same Superiors. This Kind of Life is the only one followed, and approved, at present, in the Christian Church, where it is arrived to such a Pitch of Grandeur, Opulence, and Power, that the first Institutors thereof would never know it, were they to return upon Earth.

The *Sarobites* were strolling Monks, having no fixed Rule or Residence.

The first who is thought to have assembled Monks together, into a religious Community, is St. *Pachomius*; who caused large Houses to be built for their Reception, called since *Lauræ*, and *Monasteries*.

Authors cannot agree about the Difference between a *Laura* and a *Monastery*; some pretend, that a *Laura* was a *Monastery*, wherein there lived at least a thousand Monks: But this is in no wise credible. The more natural Opinion is, that the antient *Monasteries* were the same with the modern, consisting of large Buildings, divided into Halls, Chapels, and Cells, possessed by the Monks, each of whom had his Apartment: But the *Lauræ* were a Kind of Villages, whereof each several House was inhabited by one or two several Monks at the most: So that the Houses of the *Chartreux*, seem, in some Measure, to represent the antient *Lauræ*, and those of the other Monks, proper *Monasteries*.

The Term *Laura* was only understood of the religious Places in *Egypt*, and the East, where their Houses stood a-part from each other, and were not joined by any common Cloister, the Monks that inhabited them only meeting in publick, once a Week. Therefore I am of Opinion, that the Houses inhabited by the first Monks under the Discipline of St. *Antony*, were *Lauræ*; and those inhabited by the Disciples of St. *Pachomius*, who first assembled them together in the same House, *Monasteries*.

The Orders for the Government and Regulation of those *Monasteries*, were digested into a Form, which were called since *Rules*, with the Addition of the Name of the Person who had established those *Orders*, as the *Rule of St. Antony*, of *St. Basil*, &c. which in those Days were nothing else but a certain Compilation of some Counsels of the Gospel, with some Regulations of Discipline, and which every Monk observed freely, without being constrained to it by Vow, or any other compulsive Means.

The *Canobitick* or monastical Life, above-mention'd, flourished in the East, till the Monks forsaking their first Institution, which confined them to their Desarts, *Lauræ* or *Monasteries*, began to learn something else besides *Jesus Christ*, and him crucify'd. For the common Enemy of Mankind taking Occasion of the great Reputation their exemplary Life and Piety had gained them among the rest of the Christians, to excite their Ambition, they soon began to think, that if they were worthy of being consulted by the rest of the Christians for their spiritual Conduct, they were as worthy being consulted on the Government of the Church, though excluded from it by their holy Founders; and some presumed to decide with Authority, of the unhappy Controversies, which divided then the Christian Church, to make Idolatry triumph.

The Arrogance of the Monks of those Times, went even so far on that Subject, that the Church in several Councils, was forced to make Canons to restrain it. So that their Solitudes, which till then had been admired for the Peace, Unanimity, and Concord, which reigned between the Inhabitants thereof, became soon a Theatre of Disorders and Confusion; for they divided themselves into Parties, and erected Altar against Altar, in the same Monastery, breaking sometimes into open Ruptures, and even coming to Blows. Deserting often their Solitude,

to run to the Succour of the Party they favoured most, where they committed all Sorts of Outrages and Violences; deposing Bishops, setting up others of their own Authority; dipping often their sacrilegious Hands in the Blood of their Enemies, and sometimes assailing the Throne with insolent Requests, which they obliged the Prince, by their rebellious Menaces, both to hear and to grant.

As this scandalous Conduct of the Monks, diminished much the Reputation they had acquired while they lived according to their first Institution; it contributed afterwards to render the monastick Life odious, and brought it at last, to that low and despicable State it is reduced at present: For though there are still in those Parts, Monks of the Orders of *St. Antony*, and of *St. Basil*, they are neither commendable for their Piety, nor respectable for any personal Merit; but are most of them ignorant and despicable Wretches, all infected with some of the Heresies, which have reigned most in those Countries; and all included under the general Name of *Caloyer*. *Tavernier* observes, that they live a very retired austere Life, eating no Flesh; and keeping four Lents, besides a great Number of Fasts, with great Strictness. They eat no Bread till they have earn'd it by the Labour of their Hands. During their Lents, some do not eat above once in three Days, others but twice in seven. Most of the Night they spend in Weeping, &c. they still retain their original Institution, keep their former Habit, &c. to a Tittle.

But if the monastick Life suffered so great an Eclipse in the East, it sometimes afterwards appeared with as great a Lustre as ever in the West, by the Cares of *St. Benedict*, the Restorer of the *Cenobitism*, in this Part of the World.

This holy Personage quitted *Rome*, where he was born, at the Age of seventeen, in the Year 494, according to *Cardinal Baronius*, to retire into the Desert of *Sublacus*, or *Sublaco*, forty Miles distant from the City, and where he remained three Years shut up in a Cave; till the Reputation of his Piety being spread throughout his Desert, reached the Monks of a Monastery, which was not very far from his Solitude, who desired him to take Care of their Conduct. He at first refused; but as he saw they insisted upon it, he acquiesced at last to their Intreaties, and came to their House; where he had not been long, before those who had called him, unwilling to bear the Severity of the Discipline he wanted to establish among them, formed the criminal Design of poisoning him; but *Benedict* having discovered it, abandoned them, and returned to his former Solitude, where in a short Time he built twelve Monasteries, which were soon filled with excellent Men, who led rather an angelical, than a human Life. *Maurus* was his first Disciple; he was brought to him at the Age of twelve, and made in a short Time so great a Progress under so good a Master, that he was himself the Founder of several Houses.

The Devil was yet adored on Mount *Cassin*, in an old Temple dedicated to *Apollo*; *Benedict* expelled it from the Place, and built there Oratories under the Invocation of *St. Martin*, and *St. John*: There he founded his famous Order, which did spread, in a very short Time, throughout the Earth. The Chronicle of that Order reckons in it 40 Popes, 200 Cardinals, 50 Patriarchs, 1600 Archbishops, 4600 Bishops, 4 Emperors, 12 Empresses, 46 Kings, 41 Queens, and 3600 Saints canonized; but I would not warrant this Account; and *Cardinal Baronius* has Reason to blame the Authors of that Chronicle, who, by a blind Love for their Order, have brought into it the holy Personages of all Ages; as *Tribemius* has done *Cesarius* of *Arles*, *Faustus* of *Rhiez*, and the Abbot *Eugippius*, who all lived before *St. Benedict*. How could *Cassiodorus* be one of his Disciples, he who does not so much as mention *St. Benedict's* Rules to the Monks he had assembled? We must form the same Judgment of *St. John Damascenus*, and of several eastern Fathers, who were all Monks living under the Constitutions of *St. Basil*.

In *Gaul*, the monastick Life was professed before *St. Benedict* was born; and *St. Honoratus* had already founded the Monastery of *Lerins*, and digested a Rule for their Conduct. *Cassian*, likewise, had governed the

Monastery he had founded at *Marfeilles*, under the Constitutions he had made there. It is true that the Institution we speak of, did soon spread throughout the West, and that several religious Houses received it. The Devotion was so great for the new ones which were founded, that Kings, Princes, Lords, Noblemen, and even the common People, gave their Estates, as if wanting to outvie each other, for their Foundation; engaged into it by the Sanctity of Life, and the excessive Charity of the first Monks who inhabited those Houses, and who were the faithful Oeconomists of their Revenues, for all the Poor of their Neighbourhood. But by Degrees the Riches, which could have been called the Daughters of the Devotion of the Publick, smothered their own Mother. If we want to be convinced of it, read but the Epistles of *St. Bernard*, whereby we may see the Disorders of that Order in the Abbey of *Cluny*. The Commendams were introduced, and ruined quite the Monasteries, which those who possessed them left filled of ignorant, idle, and debauched People. Therefore it was necessary, from Time to Time, to reform that great Body; which has been done in *Italy* by the Congregation of *St. Justina* of *Padua*; and in *France* by that of *St. Maur*, under the Ministry of Cardinal *Richelieu*.

These different Reformations of the Order of *St. Benedict*, are called *Congregations*. The most celebrated of them is that of *St. Maur*, as well for its immense Revenues, as for the profound Learning, extraordinary Merit, and exemplary Piety, without Hypocrisy, or Affectation, of most of its Members; and also for the good Order, and beautiful Regulations, established and religiously observed among them. The Church is indebted to them for several valuable, and useful Works; particularly of late for a new Version of the Works of *St. Augustin*. The divine Service is celebrated in their Church with that truly holy Pomp, which is a Prelibation of that everlasting Musick, which will make Part of our Felicity in the celestial Mansions.

Though the Abbeys and Priories of the Congregation of *St. Maur* be almost all in Commendam, the Chapter-General takes Care, notwithstanding, that there shall be in every House a certain Number of Monks sufficient to celebrate Divine Service with a becoming Decency, that the Intention of the Founders may not be frustrated; and to practise the Rules of the Order.

There is another reform'd Congregation of the Order of *St. Benedict*, in *France*, called of *St. Vannes*, which is neither so extended, nor so celebrated, as is that of *St. Maur*, though they do not want for good Subjects, nor for very fat Benefices.

All the reformed Congregations of the Order of *St. Benedict* abstain from Flesh, except in Time of Malady; and rise at Two in the Morning for Matins. Their claustral Superior, *i. e.* he who has the Government of the whole Monastery, is called the *Father Prior*; and he who manages their Affairs abroad, *Father Procurator*; though they have few Abbeys left them, which they call *en Regle*, and to which they promote, by Election, some of the most deserving among them; but those Abbots are only triennial, *i. e.* enjoy that eminent Post but for three Years only.

The rest of the Order, which would not accept of the Reformation, live in Opulence and Idleness, few excepted.

The *Benedictines*, like all other religious Orders, make three Vows, *viz.* of *Poverty*, *Chastity*, and *Obedience*. They wear a loose black Gown, with large wide Sleeves, and a Capuche on their Heads, ending in a Point behind.

The *CISTERCIANS*, is an Order of Religious, reformed from the *Benedictines*, consisting of an hundred Monasteries, and near as many Nunneries.

The Order took its Rise in 1075, from twenty-one zealous Monks in the Monastery of *Moleme* in *Burgundy*; who with their Abbot *Robert*, complaining that the Rule of *St. Benedict* was not strictly enough observed, obtained Permission of *Hugh* Archbishop of *Lyons*, and Legate of the Holy See, to settle in a Place called *Cîteaux*, five Miles from *Dijon*.

Here *Endes* Duke of *Burgundy* erected them a House, into which they were admitted in 1098; endowing it with a considerable Revenue. The Bishop of *Clare*

gave *Robert* the pastoral Staff, in quality of Abbot; and erected the new Monastery into an Abbey.

Such was the Beginning of the *Cisterians*, so famous in After-times, and now so extended throughout all *Europe*: And the Abbot thereof is Counsellor born of the Parliament of *Burgundy*, Superior-General of all his Order, and of five military ones, viz. *Alcantara*, *Calatrava*, *Alvis*, *Monteza*, and of *Christ*, which are in the Kingdoms of *Spain* and *Portugal*.

The Order of *Cisteraux*, was further reformed by St. *Bernard*, Abbot of *Clervaux*, towards the Beginning of the Twelfth Century; whence those reformed were called *BERNARDINS*: Therefore the *Bernardins* very little differ from *Cisterians*.

Their usual Habit is a white Gown, with a black Scapulary; but when they go to the Choir, for their Office, they put on a large white Cowl, with great Sleeves, and a Hood of the same Colour.

The *BERNARDINS* have no other Rule but that of St. *Benedict*; they abstain from Flesh, except when they are indisposed, and in the Infirmary. They also rise in the Night to their Mattins.—The Abbot of *Clervaux* is the general Superior of this Reformation, and also of the five military Orders above-mentioned.

Note, That all the Members of these different Reformations of the Order of St. *Benedict*, stile themselves *Don*, viz. *Don John*, *Don William*, *Don James*, &c. with the Addition of their Surname, and sometimes this alone with the *Don*, as *Don Calmet*, *Don Pieter*, &c. in Contradistinction of the *Mendicants*, whom they consider much beneath them, and who call themselves *Friars*.

Note, also, That the Head or Chief of the Congregations of the Order of St. *Benedict*, who refused the Reformation, is the celebrated Abbey of *Cluny*, situated in the *Masconnois*, a small Province of *France*, on the River *Soane*, and was founded by *William Duke of Berry* and *Acquitain*; or as others say, by the Abbot *Bernon*, supported by the Duke in 910. This Abbey was antiently so very spacious and magnificent, that in 1245, after the holding of the first Council of *Lyons*, Pope *Innocent IV.* went to *Cluny*, accompanied with the two Patriarchs of *Antioch* and *Constantinople*, twelve Cardinals, three Archbishops, fifteen Bishops, and a great Number of Abbots; who were all entertained without one of the Monks being put out of their Place: Though St. *Louis*, King of *France*, Queen *Blanche* his Mother, the Duke of *Artois* his Brother, and his Sister, the Emperor of *Constantinople*, the Kings of *Arragon* and *Castile*, the Duke of *Burgundy*, six Counts, and a great Number of Lords, with all their Retinue, were there at the same Time. *Cluny*, at its first Institution, was put under the Protection of the Holy See; with express Prohibition to all secular and ecclesiastick Powers, to disturb the Monks in the Possession of their Effects, or the Election of their Abbot. By this they pretended to be exempted from the Jurisdiction of the Bishops; which at length gave the Hint to the other Abbeys to insist on the same.

Cluny was famous also for having produced several good Subjects, which have been an Ornament to the Church; some of them having been placed on the Chair of St. *Peter*; but as the Monks have much degenerated from their antient Discipline, *Cluny* has likewise lost a great deal of its antient Lustre; and scarce any Thing remains of it at present, but the Name and its antient Buildings. Out of Doors their Habit is very little different from that of secular Priests; and they profess a Rule, which they seldom observe, or even mind. They have no other Lents or Abstinence, but what is observed by the Generality of Christians. They stile themselves neither *Dons* nor *Friars*, but only *Gentlemen*. Their Abbey is at present, in *commendam*, and has been so for a considerable Time, and in the House of *Bouillon*, though the Abbot stiles himself the *Abbot General of Cluny*. The present Abbot is the Abbot d'*Auvergne*, Archbishop of *Vienne* in *Dauphine*. All the Monks or Friars of the other Orders, who are tired of the Kind of Life they have embraced, and want to pass what they call

ad Laxiora, were permitted to enter the Order of *Cluny*, after they had obtain'd the Pope's Bull for the Purpose; but as such Transmigration could not be made without the Consent of the General Abbot of *Cluny*; they have thought proper lately not to be so free to give that Consent as they used to be; whereby they have excluded from among them, a great Number of worthless and idle Subjects; through Conscience, perhaps, that they had already enough in their Order.

The *CAMALDULIANS*, or *Camaldunians*, are also a Reform of the Order of St. *Benedict*, made by St. *Romuald*, in 1009; or, according to others, in 960; in the horrible Desert of *Camaldoli*, situated in the State of *Florence*, on the *Appenines*.

Their Rule is that of St. *Benedict*; and their Houses, by the Statutes, are never to be less than five Leagues from Cities.

The *Camaldulians* have not bore that Name from the Beginning of the Order; till the Close of the eleventh Century, they were called *Romualdins*, from the Name of their Founder. Till that Time, *Camaldulian* was a particular Name for those of the Desert *Camaldoli*, and Dr. *Grandi* observes, was not given to the whole Order, in Regard it was in this Monastery that the Order commenced; but because the Regulation was best maintained there.

The *Camaldulians* do not dwell in Monasteries, all under the same Roof; but have each their different Apartment, disposed in the Manner of a Street; the Superior having his at the Head thereof; tho' they eat together in a common Refectory, and visit one another, when, and as often as they please. They let their Beard grow in the Manner of the eastern Nations, and their Cloaths are brown. I have never seen but one of their Habitations, (for that Order is not very numerous) and that was the House they have in the Province of *Brie*, six Leagues distant from *Paris*, while I was with the late Prince *Ragotzki*, at the Seat which Marechal *Teffé* had near the *Camaldulians*, which he had lent to the Prince, who loved Solitude, to live in; and who had an Apartment made in one of the Gardens, in the Form of those of the *Camaldulians*, where he retired sometimes for a whole Week, attended only by a *Valet de Chambre*.

The *FEUILLANS*, which is an Order of Religious, who live under the strict Observance of the Rule of St. *Bernard*, borrow their Name from a Reform of the Order of *Bernardins*, first made Abbey of *Feuillans*, a Village in *France*, five Leagues distant from *Toulouse*, by the *Sieur Barrier*, who was Abbot thereof, 1589.

It was approved of by Pope *Sixtus V.* and the Popes *Clement VIII.* and *Paul V.* granted it its particular Superiors. King *Henry IV.* founded a Monastery of *Feuillans*, in the *Fauxbourg*, St. *Honoré* at *Paris*.

The *Feuillans* are cloathed in white, and go barefoot.

LA TRAPPE, is also a Reformation of the Order of *Cisteraux*, made in the last Century, by Don *Armand John le Boutellier de Rancé*, Abbot thereof. This Reformer, it seems, had been very debauched, though an Ecclesiastick, but being moved to Repentance by an irresistible Grace, he abandoned the World, and retired to his Abbey of *La Trappe*, in *Normandy*, which he had then, in *commendam*; and where with much Fatigue, and much more Opposition, particularly from the Order of *Cisteraux*, and from the Monks of *La Trappe*, he not only reformed himself, but likewise a few Monks whose Lives had not been much more regular than his.

This Reformation (very different from that *Luther*, *Calvin*, &c. have made in the Church, for this was to quell all our Passions, and refrain our disorder'd Appetites, and that was to indulge them all) soon made much Noise in *France*, and though attended with that Austerity, which had never been thought of before, brought a vast Number of Proselytes to the Reformer Abbot; so that in a very short Time, *La Trappe*, which till then had been a Sort of Solitude, inhabited by seven or eight Monks only at a Time, became a large Nursery of them.

The Monks of *La Trappe*, like the *Carthusians*, devote themselves to a perpetual Silence, a perpetual Fast, and a perpetual Abstinence from Flesh, was it even necessary

cessary to save their Life, and a perpetual *Cilice*. They never eat Flesh, Fish, Eggs, Cheese, nor Butter, and never drink Wine. Their whole Time is divided between Praying and Working; for they till their own Land for their Subsistence, wanting nothing else for it but what the Earth produces, as Corn for their Bread, Pulses, Roots, and Fruits for their Cyder. Their common Salutation, between themselves is this, *Frere il faut mourir*, i. e. *Brother we must die*. There are but very few Priests among them; for as they study scarce any Thing there, but their own Salvation, none of them are ordained, unless they have studied before they enter the Order, which is the Case of several of them. Their divine Service is celebrated with much Piety and Decency; their Church Musick, or rather *plain Chant*, is excellent, and very edifying.

They are clothed like the *Bernardines*, from whom they are descended, i. e. in white.

Though the Revenues of the Abbey is but very small, and the Number of Monks is very great, they are obliged by their Constitutions, to feed and refresh all Travellers, who desire it, with the same Fare they have themselves, for they are not allowed to treat with any other.

This Order has never been approved by the Holy See, but tolerated only like that of the *Cartusians*, because of the Clause in their Constitutions, which forbids eating Flesh, even at the Peril of their Life. Most commonly old Sinners retreat thither, to spend the Remainder of their Days in Penance, without taking the Habit of the Order. They have an Abbot, whom they chuse among themselves, and who is for Life.

The Reformation has met with Encouragement nowhere else, and except the *Clerets*, which is a Monastery of the same, there is no other in Christendom.

The Affair of the Constitution *Unigenitus*, caused some Confusion at *La Trappe*, as it did every where else, for the Monks divided then into two Parties, of *Constitutionaries*, and *Anti-Constitutionaries*; and the Abbot himself being for the Constitution, the contrary Party took the specious Pretence of all those who are not pleased with the Kind of Life they have embraced (*viz. a safe Conscience*) to desert their Monastery. This happen'd in 1720, and some of those Fugitives retreated to *Holland*; and some into the Archbishoprick of *Paris* under the Protection of the late Archbishop Cardinal de *Noailles*.

The *Cartusians* is also an Order of Religious, remarkable for the Austerity of their Rule, which obliges them to a perpetual Solitude, a total Abstinence from Flesh; even at the Peril of their Lives, and absolute Silence, except at stated Times. This Order was instituted by *St. Bruno*, in 1086.

Their Houses were usually built in Desarts, their Fare coarse, and their Discipline severe; but at present, though their Houses are still built out of the Tumult of Cities and Towns; the Severity of their Discipline is much mitigated, and their Fare much refined; for they, at present, eat and walk together, once a Week, and even stop where, and when they please; tho' according to their Constitutions, they should eat together, or in Community, but at all the solemn Feasts of the Year, *viz. Christmas, Easter, Whitsontide, &c.* and walk abroad but seldom, without stopping any where.

As for their Houses, they are commonly pleasantly situated, and environ'd with Woods, and very large Ponds full of Fish, for their own Use. They all live apart, round a Cloister, where they have each their Apartment, divided into several Rooms, all on a Ground Floor, and each a Garden, with a Well of Spring-Water between two. The first Room is a Kind of Vestibulum, or Hall, where they put their Fuel for their Fire, and other Incumbrances. The next is their Oratory and Library; the next to it is their Bed-Chamber; and the next to that their Laboratory; where every one follows what Business he pleases to divert his Thought, and for his own Pleasure; every *Cartusian* Monk following some particular Occupation; for some are Painters, some Sculptors, some Silversmiths, some Turners, and the like; some play on Instruments, some Study, &c. for the *Cartusian* Monks are all Priests, except some few Lay-Brothers, who are kept out of Doors, and do the

Drudgery of the Monastery; and some of them have done, by their Learning, a great deal of Honour to the Church, witness my Name-Sake *Denis* the *Cartusian*. They rise in the Night to go to Church, and their Service is very long. They are clothed in white, much like the *Bernardines*, and stile themselves *Don* like them. *Don Prior*, and *Don Praueur*, are not obliged to the Silence observed by the rest of the Monks; but may speak to whom they please, and when they please. All their Monasteries are so well founded, and so rich, that a Monk may desire what he pleases, either Books, Tools, Materials to work upon, and musical Instruments, and he has it, cost what it will; but his Works are sold for his own Use, if he desires it. Each tills his own Garden, and reaps the Fruit thereof. At their Dinner, every Monk has always two or three different Dishes, and very well dressed, a Dessert, and as much Wine as he pleases.

Note, That next in Dignity to the Order of *St. Benedict* and the Reformations thereof are the *regular Canons*.

Regular Canons, are *Canons* that still live in Community, and who like Religious, have in Process of Time, to the Practice of their Rule, added the solemn Profession of Vows.

They are called *Regular*, to distinguish them from those *Canons*, who abandon'd living in Community, and at the same Time the Observance of the *Canons* made as the Rule of the Clergy, for the Maintenance of the ancient Discipline.

Canons subsisted in their Simplicity till the 11th, others say the 12th Century, when some of them separating from the Community, took with them the Name of *Canons*, or *acephalous Priests*, because they declined to live in Community with the Bishops; and those who were left, thenceforth acquired the Denomination of *Canons Regular*, and adopted most of the Professions of the Rule of *St. Augustine*.

Note, That it is disputed to which Class the *Canons Regular* belong, whether to the Clergy, or the Religious; both the clerical and monastical State being united in them. The Point of Priority and Precedency is hotly contested, both between the *regular Canons*, and the *Priests*; and the *regular Canons* and *simple Monks*: The double Capacity of *Canons* is the Foundation of this Controversy.

All the *regular Canons*, at present, follow the Rule of *St. Augustin*, and for that Reason are called *regular Canons of St. Augustin*; such are the Congregation of *St. Genevieve*, that of *St. Victor*; and the *Norbertins*, or *Prémontrés*.

The Congregation of *St. Genevieve*, is a Reform of the *Augustine Canons*, began by *Charles Faure*, in the Abbey of *St. Vincent de Senlis*, whereof he was a Member, in the Year 1618.

The Reform soon spread into other Houses, particularly that of *Notre Dame d'Eu*, and the Abbey of *St. Genevieve*, at *Paris*, chiefly by the Interest of the Cardinal de *la Rochefoucault*, who was chose Abbot thereof in 1619; and in 1621, proposed the Reform to the Religious of his Abbey.

In the Year 1634, the Abbey was made elective; and a general Chapter, composed of the Superiors of fifteen Houses, who had now received the Reform, chose *F. Faure*, Co-adjutor of the Abbey of *St. Genevieve*, and General of the whole Congregation. Such were its Beginnings.

It has since increased very much, and now consists of above an hundred Monasteries; in some whereof the Religious are employed in the Administration of the Parishes, and Hospitals; and in others, in the Celebration of divine Service, and the Instruction of Ecclesiasticks in Seminaries for the Purpole.

The Congregation takes its Name from the Abbey of *St. Genevieve*, which is the Chief of the Order; and whose Abbot is the General thereof. — The Abbey itself took its Name from *St. Genevieve*, the Patroness of the City of *Paris*, who died in the Year 512. Five Years after her Death, *Clovis* erected the Church of *St. Genevieve*, under the Name and Invocation of *St. Genevieve*, where her Relicks are still preserved, her Shrine visited, and

and carried with great Proceffions and Ceremonies, upon extraordinary Occafions, as when fome great Favour is to be intreated of Heaven.

These regular Canons of St. *Auguftin* are cloathed in white, excepting their Cope, which is black; they alfo wear the Rochet like Bifhops.

The Religious of the famous Abbey of St. *Viftor*, at *Paris*, are alfo regular Canons; their Habit is very decent, all white, without the leaft Thing monaftical.— This Abbey has produced very learned Men, as *Hugh*, and *Richard* of St. *Viftor*, &c.

The NORBERTINES, otherwife *Premonftratenfes*, is a religious Order of regular Canons, instituted in 1120 by St. *Norbert*, whence they are called *Norbertines*.

The firft Monaftery of this Order was built by *Norbert* in the Ifle of *France*, three Leagues to the Weft of *Loan*, and by him called *Præmonftré*, *Præmonftratum*, whence the Order itfelf was denominated; though, as to the Occafion of that Name, the Writers of that Order are divided.

The Order was approved by *Honorius II.* in 1120, and again by feveral fucceeding Popes. At firft the Abftinence from Flefh was rigidly obferved. In 1245 *Innocent IV.* complained of its being neglected, to a general Chapter. In 1288 their General, *William*, procured Leave of Pope *Nicolas IV.* for thofe of the Order to eat Flefh on Journeys. In 1460 *Pius II.* granted them a general Permiſſion to eat Meat, except from *Septuageſima* to *Eaſter*.

The Religious of this Order are cloathed in White, with a ſcapulary before the Caffock. Out of Doors they wear a white Cloak and white Hat; within a little Camail, and at Church a Surplice, &c.

In the firft Monafteries built by *Norbert*, there was one for Men and another for Women, only ſeparated by a Wall. In 1137, by a Decree of a general Chapter, this Practice was prohibited, and the Women removed out of thofe already built, to a greater Diſtance from thofe of the Men.

CROISIERS, *Crucigeri*, or *Crofsbearers*, is a religious Order, or Congregation of regular Canons ſo called.

There are three Orders which have, or do ſtill bear this Name; one in *Italy*, another in the *Low Countries*, and a third in *Bohemia*.

The firft pretended to be derived from S. *Clet*, and add, that S. *Quiratus* the Jew, who ſhewed St. *Helena* the Place of the true Crofs, and was afterwards converted, reformed them. All we know for certain is, that they ſubſiſted in *Italy* before *Alexander III.* mounted the Throne; for that Pontiff flying from the Emperor *Frederic Barbaroſſa*, found an Aſylum in the Monaftery of the Croifiers, which he afterwards, in 1169, took under his Protection, giving them the Rule of St. *Auguſtin*, &c.

They were confirmed by *Pius V.* but the Diſcipline being much relaxed, they were ſuppreſſed in 1656 by *Alexander VII.*

Matt. Paris ſays, that the Croifiers bearing Staffs with Croſſes at the End, came into *England* in 1244, and preſented themſelves before a Synod held by the Biſhop of *Rocheſter*, demanding to be admitted.

Dodſworth and *Dugdale* mention two Monafteries of this Order in *England*, the one at *London*, the other at *Ryegate*; the firſt founded in 1245, the latter in 1298: Some add a third at *Oxford*, where they were received in 1349. M. *Allemand* ſays, there were fourteen Monafteries of Crofs-bearers in *England*, adding, that they came from *Italy*; thofe of the *Low Countries* diſowning them.

The Croifiers of the *Low Countries* and *France* were founded in 1211, by *Theodore* the Celles, Son of *Bofon*, who having ſerved in a Croifade in *Paleſtine*, in 1188, and there found ſome of the Croifiers inſtituted by St. *Clet*, conceived a Deſign of inſtituting another Congregation in his own Country. This is certain, that *Theodore*, at his Return from *Paleſtine* engaged himſelf in the eccleſiaſtical State; and went in Quality of Miſſionary to the Croifade againſt the *Albigenſes*; and that at his Return in 1211, the Biſhop of *Liege* gave him the Church of St. *Thibault* near *Huy*; where, with four Companions, he laid the Foundation of his Order, which was confirmed by *Innocent III.* and *Honorius III.*—*Theodore* ſent his Religious to *Thoulouze*, to join thofe of St.

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Dominic, and combat the *Albigenſes*, and the Congregation multiplied in *France*. The Popes have endeavoured to bring the Croifiers of *Italy* under thoſe of *Flanders*.

The Croifiers or Port Croix with a Star in *Bohemia*, derive their Origin from St. *Quiriacus*, and ſay they came from *Paleſtine* into *Europe*, where they embraced the Rule of St. *Auguſtin*, and built Monafteries. They add, that St. *Agnes* of *Bohemia*, to diſtinguiſh them from other Croifiers, obtained of *Innocent IV.* to add a Star to their Habit. But the Story of S. *Quiriacus* has no Foundation; and it was *Agnes* herſelf, Daughter of *Primiflas*, King of *Bohemia*, who inſtituted the Order at *Prague* in 1234. They are very numerous, and have now two Generals.

Note, That Father *Mabillon* ſhews, that till the ninth Century almoſt all the Monafteries in *Europe* followed the Rule of St. *Benedict*; and that the Diſtinction of Orders did not commence till upon the Re-union of ſeveral Monafteries into one Congregation: That St. *Ado*, Abbot of *Cluny*, firſt began this Re-union, bringing ſeveral Houſes under the Dependence of *Cluny*; that a little afterwards, in the ninth Century, the *Camaldulians* aroſe; then, by Degrees, the Congregation of *Vallombroſa*; the *Ciſtertians*, *Carthuſians*, *Auguſtines*; and at laſt, in the thirteenth Century, the *Mendicants*. He adds, that *Lupus Servatus*, Abbot of *Ferrieres*, in the ninth Century, is the firſt that ſeems to diſtinguiſh the Order of St. *Benedict* from the reſt, and to ſpeak of it as a particular Order.

Note, alſo, That next comes the numerous Families of the *Mendicants*.

MENDICANTS, is a Term applied to ſeveral Orders of Religious, who live on Alms, and go begging from Door to Door.

There are four antient Orders which paſs principally by the Name of the four *Mendicants*, viz. the *Franciſcans*, *Dominicans* or *Jacobines*, *Carmelites*, and *Auguſtines*.

The FRANCISCANS, is a religious Order, founded in the Beginning of the thirteenth Century, by the Son of a Merchant of *Aſſiſum* in the Province of *Ombria*, in *Italy*, called *Francis Bernardone*; whence their Name *Franciſcans*. Contrary to the Maxims of the Founders of all other religious Orders, *Francis* renounced all Revenues, under what Denomination ſoever, either of Foundation, Gifts, or the like; and truſted entirely to the divine Providence for the Subſiſtence of his Family; therefore he obliged his Diſciples, in the three Vows they make, like the reſt of the Monks and Friars, to expreſs that of Poverty, by theſe two particular, and more ſignificative Words, SINE PROPRIO, i. e. without any Property; ſo that they even renounce that of their own Houſes, Gardens, Cloaths, Books, &c. which they ſay belong to the Pope; they living entirely on Alms, and begging from Door to Door.

The firſt Houſe of that Order was a ſmall Chapel, which St. *Francis* obtained from the *Benedictine* Monks of *Aſſiſum*, and which he called *Portiuncula*, the ſmall Portion.

This was the Cradle of that numerous Progeny, which divided ſoon into ſeveral Branches; and has been ſince diſſuſed throughout the whole Earth. Thoſe ſeveral Branches, all cloathed in a different Manner, and all pretending to wear the true Dreſs of the Order, are the *Conventuals*, *Obſervantines*, *Cordeliers*, *Capuchins*, and *Recoleſts*.

The *Conventuals*, are the leſs fruitful Branch of the Order of St. *Francis*, though they pretend to be his firſt-born; and their Houſes do not ſmell much of that ſtrict Poverty they profeſs. They are moſt confined in *Italy*; they have alſo a Houſe at *Avignon*, which I have ſeen, and where every Friar has two Apartments, one for the Summer and another for the Winter, more proper for a Perſon of the firſt Quality, than for a Mendicant Friar, and a Diſciple of St. *Francis*.

The Habit of the *Conventuals* is black, their Sleeves large, and their Capuche wide, and not prominent. They wear a Cord round their Waſte inſtead of a Girdle, like the reſt of the Order; but it is a very ſmall, very white, being made of Cotton, and very ſoft one. They

also wear Linnen, Shoes, and Stockings, contrary to the Example which their Patriarch gave them.

There are two Sorts of OBSERVANTINES, viz. of the *great* and *lesser Observance*.

Those of the *great Observance*, are very little or not at all different from the Conventuals, unless it be in the Form and Colour of their Habit.

Those of the *lesser Observance*, are called Cordeliers, and cloathed sometimes in thick grey Cloth, sometimes finer, if they can afford it of their own Perquisites, with a little Cowl, a Chaperon, and Cloak of the same; having a Girdle of Rope, or Cord tied with three Knots, signifying their three Vows, of *Chastity*, *Poverty*, and *Obedience*. From this Cord they were called *Cordeliers*.

The *Cordeliers* are otherwise called *minor Friars*, the original Name of the whole Order in general. The Denomination *Cordelier* is said to have been first given them, in the War of St. Louis, King of France, against the Infidels, wherein the *Friars minor* having repulsed the *Barbarians*, and the King having enquired their Name, it was answered they were People *Cordeliez*, tied with Ropes. The *Cordeliers* have produced, and produce still a great Number of very learned and profound Theologians, and very eloquent Preachers; they are received into the *Sorbonne* and made Doctors thereof: Their Church Musick is much admired, and they delight in having a great Number of very good Voices; therefore we say in France, *un Cordelier en Chœur*, to signify that the Cordeliers sing well. *Sixt. IV.* and *John XX.* Popes, were both Cordeliers.

The *Conventuals*, *Observantines*, and *Cordeliers*, seldom beg at present from Door to Door, unless their Convent be very poor indeed.

The CAPUCHINS (thus called from their *Capuche* or *Capuchon*, a Stuff Cap, or Cowl, wherewith they cover their Heads) is a Reform from the Cordeliers, set on Foot in the sixteenth Century, by *Matthew Bassi*, a Religious of the Monastery of *Monte Fiascone*, who being at Rome, was advertised several Times from Heaven, to practise the Rule of St. Francis to the Letter. Upon this he made Application to Pope *Clement*, in 1525, who gave him Permission to retire into a Solitude, and not only him but as many others as would embrace the strict Observance; which some did accordingly. In 1528 they obtained the Pope's Bull. In 1529 the Order was brought into compleat Form; *Matthew* was elected General, and the Chapter made Constitutions. In 1543 the Right of Preaching was taken from the *Capuchins* by the Pope: But in 1545 it was restored to them again with Honour. In 1578 there were already seventeen general Chapters in the Order of the *Capuchins*.

The *Capuchins* observe the Rule of St. Francis to the Letter.—They are cloathed with a very coarse brown Cloth; wear no Linnen, go bare-legg'd, and bare-footed, except that they wear Sandals; never shave their Beard, and are not allowed to ride, either in a Coach or on Horse-back, except in case of an extream Necessity; the General excepted, who, when he visits his Order, rides on a Mule, which the Pope presents him with soon after his Election to the Generalate.

The *Capuchins* are not accounted very learned, because they are disturbed from their Studies by their frequent Beggings, without which it would be impossible for them to subsist, since they have not the least Possession in the World; but they are in general of a consummate Piety, and very exemplary Life. There is a great Number of Persons of Distinction among them, especially in the Province of *Britanny*, where they are extreamly respected. They send Missionaries into the *Levant*, the *East*, and *West-Indies*, and on the Coast of *Africa*, who work to the Conversion of the Infidels.

The RECOLLECTS, are also a Reform from the Cordeliers.

They were established about the Year 1530, when some Religious of the Order of St. Francis, willing to keep his Rule to the Letter (which has always been the Pretence of all the Reformers) *Clement VII.* gave them Houses, particularly *Yulles* in the *Limosin*, and *Murat* in *Auvergne*, whither they might retire, and receive such as were disposed to follow them. The same Year he approved the Reform; and in 1584 it was carried into *Italy*.

The Habit of the *Recollect*, is of the same Colour of that of the Capuchins, i. e. a brown coarse Cloath, but the Form is different, for the Capuce is shorter, and they wear the Chaperon like the Cordeliers, which they call *Mosette*. Their Cloak is tied under their Chin, with a Kind of Fastening made of Wood, or of Box, very well turned; which they call *Tibi*. They wear no Linnen, and go bare-legged and bare-footed; wearing only Socks, as they call them, which is a Kind of Sandal; the Soal and Heels thereof are of Wood.

Note, All the different Branches of the Order of St. Francis, above-mentioned, possess no apparent Revenues; but the Conventuals, Observantines, and Cordeliers, receiving Foundations, burying in their Houses, assisting at Buryings, for which they are handsomely paid, as well as for their Masses, Sermons, &c. are not so burthenfome to the publick, as are the Capuchins and Recollects, who have nothing to depend upon but the Retribution of their Masses, and that of their Sermons when they preach a Lent, Advent, or a Dominical, in the Cathedral Churches, i. e. every Sunday throughout the whole Year, the Advent, Lent, and Sunday in the Octave of *Corpus Christi* excepted, all which is not capable to maintain a Monastery of twenty, thirty, forty, and sometimes fifty Religious, who, therefore, are obliged to have Recourse to the publick Charity for the rest; which is the only Clause in the Rule of St. Francis, and in all other Rules of Mendicants, which I cannot approve. For if we consult all the ecclesiastical Historians, who have wrote before the Establishment of the Mendicants, we'll find, that the Intention of the first Founders of the monastick Life, was, that they all should work for their Subsistence; and that to act otherwise, is entirely contrary to the Practice of the Apostles, and of St. Paul in particular, who calls the Faithful to witness, that he was burthensome to none of them, but worked with his own Hands for his Subsistence, though not brought up to it, since he learned a Trade after he was called to the Apostolate. It is true, that since our Times are different from those of the Primitive Church, and a Christian Liberality have provided with a prodigal Hand for the Subsistence of the Ministers of Christ, those who serve to the Altar should live by the Altar; but the Number of those holy Servants, should not exceed the Revenue sufficient to maintain them, and if it does, they should make up the Deficiency thereof, by their own Industry, and not by a lazy Life, which is dishonourable to the Sacerdote, and oppressive to the Publick. How cruel it is to see a Friar, whose sole Aspect witnesses nothing less than Indigence, teasing a poor Handicraft Man for Relief, who can scarce maintain his own Family with the Sweat of his Brows, and which perhaps would be very well fed and satisfy'd with the Crumbs which fall from the Table of the Person who pleads Poverty to him, and will not leave him, till he has extorted something from him? If they must beg, let them beg among the Rich only, who can relieve them out of their Plenty, without feeling it: But Princes, in whose Dominions the Mendicant Friars are established, should forbid them, under severe Penalties, robbing the industrious Part of their Subjects of the Fruits of their Industry and Labour; for if Charity has the Power to open the Gates of Heaven, as those devout Mendicants are themselves pleased to tell us, it is when well applied, i. e. to worthy Objects thereof, and who really want; but do these really want, and are they worthy Objects of Charity, who have so many Means of relieving themselves if they please, without being oppressive to the poorest Sort of People? Do those really want, who feed on Delicacies, while those they beg from, think themselves too happy, if they have a very frugal Sufficiency, to keep themselves and Family from starving? I'll never be persuaded, that to renounce all that one possesses in the World, under Pretence of following Christ, is a Sacrifice agreeable to him, when that Sacrifice is to be offer'd on so bloody an Altar as is the publick Oppression. It would be much more according to the Maxims of the Gospel, much more disinterested, and more generous, if those holy Sacrificators would think that if they renounce their Possessions, it is to be no

at Liberty, to bear the whole Weight of the Punishment which God inflicted on the Original Sin, when he said to *Adam*, *Thou shalt eat thy Bread by the Sweat of thy Brows.*

All the Order of *St. Francis*, at least all those above-mentioned, keep three Lents in the Year, according to their Rule, viz. the first, which begins at *All-Souls Day*, and ends at *Christmas*; the second, which begins the next Day after the *Epiphany*, and ends at the *Sexagesima*; and the last, is the Lent kept by the *Catholics*, i. e. from *Ash-Wednesday* to *Easter*.

They also rise at twelve at Night to go to Church. The *Capuchins* and *Recollets* have no Church Music, but Psalmody their whole Office.

There is also a *third Order of Franciscans*, instituted by *St. Francis* himself, in 1221, in Favour of People of both Sexes, who being smitten with the Preaching of that Saint, demanded of him an easy Manner of living a Christian Life; upon which he gave them a Rule, the Constitutions whereof are not now extant, as wrote by himself, but only as reduced and confirmed by *Pope Nicolas IV.* 68 Years afterwards.

Of this Order, which was only established for secular Persons, several of both Sexes, to attain the greater Perfection, have since commenced Religious, and form'd various Congregations, under various Names, as *religious Penitents of the third Order*, &c.

The *DOMINICANS* are also one of the Mendicant Orders, and take their Name from their Founder *Dominick de Gusman*, a *Spanish* Gentleman, born in 1170, at *Calaveger* in *Old Castile*. He was first Canon and Archdeacon of *Osma*; and afterwards preached with great Zeal and Vehemence against the *Albigenses* in *Languedoc*, where he laid the first Foundation of his Order. It was approved of in 1215, by *Innocent III.* and confirmed in 1216; by a Bull of *Honorius III.* under the Rule of *St. Augustin*, and the Title of *Preaching Friars*.

The first Convent was founded at *Thoulouse*, by the Bishop thereof, and *Simon de Montford*. Two Years afterwards they had another at *Paris*, near the Bishop's House; and sometimes after a third in the *Rue St. Jacques*, *St. James's Street*, whence the Denomination of *Jacobines*.

St. Dominick, at first, only took the Habit of the regular Canons, that is, a black Cassock and Rochet; but this he quitted in 1219, for that which they now wear, which, it is pretended, was shewn by the Blessed Virgin herself to the beatified *Renaud d'Orleans*. It is a white Cassock, a black Scapulary, and black Camail, with a very wide Cowl, lined with white, or rather two Camails, one white, the other black, and over all, a large Cloak or Cap, reaching almost to the Ground.

This Order is diffused throughout the whole Earth. It has 45 Provinces under the General, who resides at *Rome*; and 12 particular Congregations, or Reforms, govern'd by Vicars General.

They reckon 4 Popes of this Order, above 60 Cardinals, several Patriarchs, 150 Archbishops, and about 800 Bishops, besides Masters of the sacred Palace, whose Office has been constantly discharged by a Religious of this Order, ever since *St. Dominick*, who held it under *Honorius III.* in 1218. *St. Thomas Aquinas*, called the *Angelick Doctor*, was of this Order.

Note, That it was *St. Dominick*, who was the first Promoter of the Inquisition, under *Pope Innocent III.* That Pontiff sent several Priests, with *St. Dominick* at their Head, to *Thoulouse*, to give him an Account of the Number of Hereticks in those Parts, and of the Behaviour of Princes and Prelates towards them; and thence they acquired the Name of *Inquisitors*: But these original *Inquisitors* had not any Court, or any Authority; they were only a Kind of spiritual Spies, who were to make Report of their Discoveries to the Pope. The Emperor *Frederick II.* at the Beginning of the 13th Century, extended their Power very considerably, and committed the taking Cognizance of the Crime of Heresy, to a Set of ecclesiastical Judges; and as Fire was the Punishment decreed for the Obdurate, the *Inquisitors* determined indirectly with Regard both to the Person and the Crimes: By which Means the Laity was cut off from its own Jurisdiction,

and abandoned to the Zeal and devout Madnefs of the Ecclesiasticks. After the Death of *Frederick*, who had long ago repented the Power he had given the Churchmen, as having seen some of the Fruits of it; *Pope Innocent IV.* erected a perpetual Tribunal of *Inquisitors*, and deprived the Bishops and secular Judges, of the little Power the Emperor *Frederick* had left them. And this Jurisdiction, which depended immediately on himself, he took Care to introduce into most of the States of *Europe*. But the *Inquisitors* were so fiery, hot, and made such Butchery among the Hereticks, that they raised an universal Detestation, even in some Catholick Countries themselves. Hence it was that their Reign proved very short both in *France* and in *Germany*; nor was even *Spain* entirely subject to them till the Time of *Ferdinand* and *Isabella*, in 1448, when their Power was increased, under Pretence of clearing the Country of *Judaism* and *Mahometanism*. The Power of the *Inquisition* is very much limited in some Countries, particularly at *Venice*, where it is received under such Modifications, as to prove a great Check to its Authority. Indeed, at *Venice*, it seems rather a political than a religious Contrivance, and serves rather for the Security of the State, than of the Church. There are Appeals from the subaltern *Inquisitions* in *Italy*, to the Congregation of the Holy Office residing at *Rome*. It is the constant Practice of the *Inquisition*, to affect, in all their Procedures, to inspire as much Terror and Amazement as possible; every Thing is done with the profoundest Silence and Secrecy, and with the greatest Rigour and Impartiality. When a Person is seized, all the World abandons him, not the nearest Friend dares to speak a Word in his Defence; that alone would be enough to render them suspected of Heresy, and would bring them within the Claws of the *Inquisition*. The Criminals are seized, examined, tried, tortured, and unless they recant, condemned, and executed, without ever seeing or knowing their Accusers; whence the Revengeful have a fair Occasion of wreaking their Malice on their Enemies. When the *Inquisition* has done with them, and condemned them to Death, they are turned over to the secular Arm, with a World of Prayers and pious Intreaties, that their Lives may not be touched. Time is no Manner of Security in Point of Heresy; nor does the Grave itself shelter the Accused from the Pursuits of the *Inquisition*; even the Deceased have their Trials, and they proceed in all their Form and Solemnity against the dead Carcasses. The Executions are always deferred till the Number of the condemned is very great, that the Multitude of Sufferers may strike the deeper Horror, and make the Scene more shocking and terrible. The *Inquisition* of *Rome* is a Congregation of 12 Cardinals, and some other Officers, where the Pope presides in Person. This is accounted the highest Tribunal in *Rome*; it began in the Time of *Pope Paul IV.* on Occasion of the spreading of *Lutheranism*. The *Inquisition* is very severe in the *Indies*. It is true there must be the Oaths of seven Witnesses to condemn a Man; but then the Depositions of Slaves or Children are taken. The Person is tortured till he condemns himself, for his Accusers are never brought to confront him. Persons are accused for the slenderest Expression against the Church, or even for a disrespectful Word of the *Inquisition*. The Standard of the *Inquisition* is a Piece of red Damask, on which is painted a Cross with an Olive-Branch on one Side, and a Sword on the other: With these Words of the Psalmist, *Exurge Domine, & Judica causam meam*. The *Dominicans* have always been *Inquisitors*, ever since their Patriarch *St. Dominick*; though it must not be supposed, that his Intention was, when he proposed the *Inquisition* first, that it should be made a hellish Tribunal, abhorred by Heaven and Earth; his great Zeal for the Faith, and the Extinction of Heresy, if it could be accused of Indiscretion, was not criminal.

The *CARMELITES*, who are also reckoned Mendicants, are religious, who take their Name from *Carmel*, a Mountain of *Syria*, formerly inhabited by the Prophet *Elias* and *Elisba*, and by the Children of the Prophets;

from whom this Order pretends to descend in an uninterrupted Succession.

The Manner in which they make out their Antiquity has something in it too ridiculous to be rehearsed. Some among them pretend they are Descendants from *Jesus Christ*: Others go further, and make *Pythagoras* a *Carmelite*, and the antient Druids regular Branches of their Order.

Phocas, a Greek Monk, speaks the most reasonably; he says, that in his Time, viz. in 1185, *Elias's* Cave was still extant on the Mountain, near which were the Remains of a Building, which intimated there had been antiently a Monastery; that some Years before an old Monk, a Priest of *Calabria*, by Revelation, as he pretended from the Prophet *Elias*, fixed there, and assembled ten Brothers. In 1209, *Albert* Patriarch of *Jerusalem*, gave the Solitaries a rigid Rule; which *Papebroch* has since printed. In 1217, or according to others in 1226, Pope *Honorius III.* approved and confirmed it; though it was afterwards mitigated by *Innocent IV.* *St. Louis*, King of *France*, brought some of these *Carmelites* with him from the Holy Land into his Kingdom: Many of the Popes give them the Title of *Brothers of the Blessed Virgin*.

This Order is eminent for the Order of the Scapulary, for its Missions, and its great Number of Saints. In the last Century, there were four Canonizations of this Order, viz. of *St. Theresa*, *St. Andrew Corsin*, *St. Magdalaine de Pazzi*, and *St. John de la Croix*.

The Order of *Carmelites* is divided into two Branches, viz. *Carmelites of the antient Observance*, called the *mitigated*, or *moderate*, and those of the *strict Observance*, called *bare-footed Carmelites*.

The *antient Observance* has only one General, under whom are forty Provinces; and the Congregation or *Mantua*, which has a Vicar-General.

Their Habit, is a black Cassock, a white Cloak or Cop, reaching almost to the Ground, and a white Cowl.

The *strict Observance*, has two Generals, one in *Spain*, having six Provinces under his Command; and another in *Italy*, with twelve in several Parts of *Europe*.

Bare-footed Carmelites, are a Reform of the *antient Carmelites*, set on foot in 1540 by *Theresa*, so called from their going bare-footed.

She began with the Convents of Nuns, whom she restored to the primitive Austerity of the Order, which had been mitigated by *Innocent IV.* in 1245; and at length carried the same Reform among the Friars. *Pius V.* approved the Design, and *Gregory III.* confirmed the Reform in 1580.

There are two Congregations of *bare-footed Carmelites*, which have each their General and their several Constitutions; the one the *Congregation of Spain*, divided into six Provinces; the other called the *Congregation of Italy*, comprehending all the rest, not depending on *Spain*.

Their Habit is a brown Cassock, a white scanty Cop, or Cloak, and a Cowl of the same Colour.

F. Diego de Coria Maldonado, a *Spanish Carmelite*, has a particular Treatise on the third Order of the *Carmelites*, where he derives them immediately, as well as the *Carmelites* themselves, from the Prophet *Elias*; and among the great Men who have made Profession of that third Order, reckons the Prophet *Obadiab*, who lived 800 Years before Christ; and among the Women our Saviour's Great Grandmother, under the borrowed Name of *St. Emerentiana*. This *Obadiab*, he says, was Controller-General of the House of King *Abab*, mentioned in the first Book of *Kings*, chap. xviii. and Disciple of the Prophet *Elijab*. After serving that Prince and his Successors, he retired to serve God, and entered the prophetick Order of *Elijab*, but without quitting his House, his Wife, or Children.

The Author adds, that he was not properly of the third Order but of the second, which consisted of married People, and was called the Order of *Eunuchs*, under the Direction of *Elijab*. Such, according to him, is the Foundation of the third Order of the *Carmelites*.

F. Helyot shews, that this third Order was not in Being until the Year 1476, when *Sixtus IV.* gave Permission to the Prior and Provincials of the *Carmelites* to give the regular Habit and Rule of their Order to People of both Sexes, married or unmarried, living at Liberty in the

World. *De Coria* reckons *St. Louis* King of *France*, in the third Order of the *Carmelites*.

Note, That this Order has never been very famous for Subjects of Merit, and has not produced a great Number of very learned Men. But however, the *Carmelites* in general, whether of the antient or strict Observance, lead a very exemplary Life, and are not oppressive to the Publick.

The *AUGUSTINES*, or *Augustinians*, make also one of the four Orders of the Mendicants; and are called *Augustins* from *St. Augustin*, whose Rule they observe.

The *Augustins*, popularly also called *Austin Friars*, were originally Hermits, pretended to have been instituted by *St. Augustin* himself, but without much Ground. This is pretty certain, he laid the Foundations of a monastick Order about the Year 388, and retired to his Father's Estate near *Tagasta*, to lead a religious Life with some Companions: But it does not at all appear, that this Order has subsisted ever since, nor that the Hermits of *St. Augustin* are descended without Interruption from them.

This Order in Reality only commenced under *Alexander IV.* in the Middle of the thirteenth Century; and was formed gradually by the Union of divers Congregations, which had no Rule, or at least had not that of *St. Augustin*. Those Congregations were that of *John Bonites*, the most antient of all; that of the *Hermits of Tuscany*; that of the *Sack*, or *Bag*; those of *Vallerfuta*, of *St. Blaise*, of *St. Benedict de Monte Fabalo*, of the *Tower of Palmes*, of *Sancta Maria de Murcella*, of *St. James de Molinio*, and the *Loupsavo* near *Lucca*.

This Coalition was not made by *Innocent IV.* as most Historians of the Order contend; all that Pontiff did was to unite some *Hermits* in *Tuscany*, to whom he gave the Rule of *St. Augustin*; but these were a distinct Body from those just mentioned. It was *Alexander IV.* that made the grand Union, as appears from his Bull published in the *Magnum* of the *Augustins*.

That Pontiff undertook this Union from the first Quarter of his Pontificat, viz. in the Year 1254. It was the Year 1256, ere the Superiors of all the Congregations could be got together. In the general Chapter the Union was effected: *Lanfranc Septala*, a *Milaneze*, was chosen General; and the Order divided into four Provinces, viz. those of *France*, *Germany*, and *Italy*.

Since that, other Orders have been united to the *Hermits* of *St. Augustin*; as the poor Catholics, &c. and the Order now consists of 42 Provinces.

After so many Unions the Order began to divide again into separate Congregations, according to the Relaxations and Reforms that afterwards got Footing. Such are the *bare footed Hermits* of *St. Augustin*; the Congregation of *Centorbi*, or the *Sicilian Reform*; the Congregation of the *Colorites* in *Calabria*, &c.

The *Augustins* are clothed in Black.

The third Order of *Augustins*, if we credit *F. Bruno*, was instituted by *St. Augustin* himself: But the Arguments he produces are so frivolous, that *F. Heliot* observes they are not worth the refuting.

Note, That the *Dominicans*, *Carmelites*, and *Augustins*, though accounted Mendicants, seldom beg from Door to Door, unless it be now and then, for Form Sake, and in Places where they are very poor indeed; and they seldom fix on such Places. The *Dominicans* have publick Schools of Philosophy, and Theology, where they teach the Doctrine of *St. Thomas*; and from which they reap some Benefits, which help towards their Subsistence.

I place the *MINIMS* next the *Mendicants*, because *St. Francis de Paulo*, their Patriarch, derived their Name *Minims*, q. d. *least* or *smallest*, from that of the *Franciscans*, who call themselves *Minors*.

This Order was instituted in 1440, and brought into *France* by *St. Francis de Paulo* himself, under the Reign of *Louis XI.* at that Prince's Solicitation, who thought that *St. Francis de Paulo's* Prayers could lengthen his Life.

The *Minims* abstain from Flesh, Cheese, Butter, &c. and dress all their Food with Oil; but in such a Manner as to render it of a delicious Taste; at least I have

been regaled with some very good Dishes in their Houses.

They are dressed in black, and wear also a small black Cord, instead of a Girdle, in Imitation of the *Franciscans*. They have no Church-Musick, but psalmodize all their Office.

I place next the *TRINITARIANS*, though a more ancient Order than the *Minims*; thus called, because they were instituted in Honour of the Trinity, for the redeeming of Christian Captives from the Infidels; vulgarly called *Matburins*, from their Monastery at *Paris*, and Brothers of the Redemption.

They are cloathed in white, and bear on the Stomach a Cross, partly red, and partly blue; by which three Colours, white, red, and blue, is supposed to be represented the Myſtery of the Trinity.

The *Trinitarians* make it their Business to go and ransom Christians held in Slavery in the Republicks of *Algiers*, *Tunis*, and *Tripoli*, and the States of *Morocco*. They have a Rule peculiar to themselves; tho' several Historians rank them among the Observers of the Rule of *St. Augustin*.

The Order had its Rise in 1198, under the Pontificate of *Innocent III.* the Founders were *S. John de Matba*, and *Felix de Valois*: The first of *Faucon* in *Provence*; the second, not of the Royal Family of *Valois*, as some have imagined; but thus called, in all Probability, as being a Native of the Country *Valois*.

Gaubier of *Chatillon* was the first who gave them a Place in his Land to build a Convent; which afterwards became the Chief of the whole Order: *Honorius III.* confirmed their Rule. *Urban IV.* appointed the Bishop of *Paris*, and others, to reform them: They did it, and the Reform was approved in 1267, by *Clement IV.*

This Order possesses about 250 Convents, divided into 13 Provinces; whereof six are in *France*, three in *Spain*, one in *Italy*, and one in *Portugal*. Formerly there was one in *England*, another in *Scotland*, and a third in *Ireland*. But the Reformers have thought, that the Slaves of those three Kingdoms might very well ransom themselves if they pleased.

In the general Chapters held in 1573 and 1576, a Reform was order'd, and begun sometime afterwards by *Julian de Nantonville*, and *Claude Aleph*, two Hermits of *St. Michael*, but now permitted by Pope *Gregory* to take the Habit of the Trinity; upon which their Hermitage was converted into a House of the Order.

In 1609, the Pope allowed them to build new Houses, and to introduce the Reform into the old ones. In 1635, *Urban VIII.* by a Brief, appointed the Cardinal de *Rocheſaucaut*, to introduce the Reform into all the Houses of the Order, which was done accordingly, by a Sentence containing the Reform in eight Articles; the principal whereof were, that they should observe the primitive Rule approv'd of by *Clement IV.* should abstain from Flesh, use woollen Shirts, have Mattins at Midnight, &c. In 1554, there was also a Reform made among those of *Portugal*.

The Habit of the *Trinitarians* is different in different Countries, and that of the Reformed different from the rest.

There are also bare-footed *TRINITARIANS*, who are a Reform of this Order, made in *Spain*, in a general Chapter, held in 1594, where it was resolved, that each Province should establish two or three Houses, where the primitive Rule should be observed, and where the Religious should live up to a greater Austerity, use coarser Cloaths, &c. and yet should have the Liberty of returning to their ancient Convent, when they thought fit.

Don Alvarez Bafan, intending to found a Monastery at *Vadepagnas*, and desiring to have it occupied by bare-footed Religious, it was agreed to add Nudity of Feet to the Reform, that the *Trinitarians* might have the Benefit of that Establishment. The Reform afterwards grew into three Provinces, and was at last introduced into *Poland* and *Russia*: And thence into *Germany* and *Italy*.

There are also bare-footed *Trinitarians* in *France*, established by *F. Jerom Hallius*, who being sent to *Rome* to solicit the first Reform mentioned above; not content therewith, carried it further, and obtained a Permission of Pope *Gregory*, to add a coarse Habit, and Nudity of

Feet thereto. He began with the Convent of *St. Dionysius* at *Rome*, and those of *Aix* in *Provence*.

In 1670 there were Houses enough of this Reform to make a Province, and accordingly they held their first general Chapter the same Year.

Note, That there are still subsisting several Orders, who stile themselves *Hermits*, though they retain but the bare Name thereof, as the *Hermits of St. Augustin*, and the *Camalduly* heretofore mentioned, the *Hermits of Brittini*, the *Hermits of St. Jerom*, the *Hermits of St. John Baptist*, otherwise called *Jeronymits*, the *Hermits of St. Paul*, &c.

The *Hermits of Brittini*, was a Congregation formed under Pope *Gregory IX.* who gave them the Rule of *St. Augustin*.

Their first Hermitage or Abode, was in a solitary Place called *Brittini* in the Marquisate of *Ancona*; whence their Name, they led a very austere Life, never eat any Meat, and fasted much.

The *Hermits of St. Jerom*, or *Jeronymites*, or *Hieronymites*, is a Denomination given to divers Orders or Congregations of Religious.

The first called *Hermits of St. Jerom* of *Spain*, owe their Origin to the third Order of *St. Francis*, whereof the first *Jeronymites* were Members. *Gregory XI.* confirmed this Order under the Name of *St. Jerom*, whom they had chosen for their Patron and their Model, and gave them the Constitutions of the Convent of *St. Mary* of the Sepulchre, with the Rule of *St. Augustin*; and for Habit a white Tunick, with a Scapulary, a little Capuche, and a Mantle, all of their natural Colour without dying, and of a mean Price.

The *Jeronymites* are in Possession of the Convent of *St. Laurence* in the *Eſcurial* where the Kings of *Spain* are buried.

Hermits of St. Jerom, of the *Observance*, or of *Lombardy*, were founded by *Lupus d'Olmedo* in 1424, in the Mountains of *Cazalla*, in the Diocese of *Seville*.

The third Order of *Jeronymites* was founded by *Peter Gambacorti*, about the Year 1377; but the Vows they made were only simple, till the Year 1568, when *Pius V.* appointed them to be solemn. They have Houses in *Tirol*, *Italy*, and *Bavaria*.

The fourth Congregation of *Jeronymites*, or the *Hermits of St. Jerom of Fieroli*, began in 1360. When *Charles de Monte Grenali*, of the Family of the Count of that Name, retiring into Solitude, first established it at *Verona*. It was approved by *Innocent VII.* under the Rule and Constitutions of *St. Jerom*: But *Eugenius* in 1441 changed it for that of *St. Augustin*. As the Founder was of the third Order of *St. Francis*, they preserved that Habit; but in 1460, *Pius* permitting such as pleased to change it, occasioned a Division among them. This Order was finally suppressed in 1668.

The *Hermits of St. John Baptist*, was a religious Order in *Navarre*, whose principal Convent or Hermitage was seven Leagues from *Pampelona*.

Till the Time of *Gregory XIII.* they lived under the Obedience of the Bishop of that City; but the Pope confirmed them a religious Order, approved their Constitutions, and admitted them to make the Vows. Their Way of living was exceeding austere: They went bare-footed, wore no Linnen, lay on Boards, with a large Stone for a Pillow, and bore a large wooden Cross upon their Breasts.

Their House was a Kind of *Laura*, rather than a Convent cantoned out into Cells, in which they lived solitary in the Middle of a Wood.

The *Hermits of St. Paul* the first *Hermit*, is an Order formed in the thirteenth Century, by the Union of two Bodies of *Hermits* in *Hungary*, viz. those of *St. James de Patach*, and those of *Pifilia* near *Zante*.

Upon their being incorporated, they chose *St. Paul* the first *Hermit* for the common Patron and Protector of their Order, and assumed his Name. They multiplied very considerably in *Hungary*, *Germany*, *Poland*, and other Provinces; and came to have seventy Provinces in *Hungary* alone; but the Revolutions and Wars in that Kingdom reduced them again.

Note, That the next that follows in Order, are what we

we call regular Priests, or Clerks, as the *Fathers of the Oratory*, the *Jesuits*, *Jesuites*, *Fathers of the Mission*, or of *St. Lazarus*, the *Theatins*, &c.

The *Fathers*, or *Priests of the Oratory*, is a celebrated Congregation of Priests, who live together in a monastick Manner, but without Vows, first established at *Rome*, about the Year 1590, by *St. Philip Neri*, a *Florentine*, under the Title of *Oratory of Santa Maria in Valicella*.

On the Model of this the Cardinal *Berulla*, established a Congregation of the *Oratory of Jesus* in 1612, in *France*, which has since increased; so that there are now 60 Houses of Priests of the Oratory in the Kingdom.

There is some Difference however, between the *Italian* and *French* Institutions. *St. Philip Neri*, to prevent the Confusion which the great Number of Houses usually occasion in Congregations, would have his to be a single House. And though others were at Liberty to form the like Congregations, yet they were to have no Dependence on one another.

For this Reason the Houses of the Oratory in *Italy* and *Flanders* are all independent; whereas those in *France* have all a Relation to each other, and all depend on the same Chief, who has the Quality of Superior General; and with three Assistants govern the whole Congregation.

The chief Occupation of the Priests of the Oratory is the Instruction of Youth, for which Purpose they have publick Schools in the Places where they are established. They are most of them Men of the greatest Piety, and most profound Erudition; and have among them very good Philosophers, profound Theologians, and excellent Orators; who fill with great Reputation and an universal Applause the best Chairs in *France*, and have often the Honour to preach before the King.

The Priests of the Oratory and the *Jesuits* are Antagonists, as well in Point of Doctrine, as by a Motive of Emulation; the former espouse the Doctrine of *St. Augustin* on Grace, which they teach efficacious of itself; and the latter the Doctrine of *Molina*, a famous Theologian of their Society, who rejects that Sort of Grace, and pretend that it is no otherwise efficacious, but by the Consent of our Will.

The *Priests of the Oratory*, in general, have seldom any other Ambition, than to acquit themselves well of their publick Functions, and never thrust themselves into the Palaces of Princes, and are never seen there unless they be called to it. I was educated by them from seven Years of Age, to eleven and a half, when I made my first Voyage to Sea, with the Marquis *de Coetlogon*, my Uncle, afterwards Vice-Admiral of the *Ponant*, and Marshal of *France*; but the Peace being concluded soon after, I returned to my Studies under the same Masters, without neglecting entirely the military Profession I was designed for, if my Misfortunes had not proved an Oblacle to it.

The *Priests of the Oratory* are at Liberty to stay in the Congregation as long as they please, and to go out of it when they please.

The *Jesuits*, is an Order of Religious, founded by *Ignatius Loyola*, called also the *Society of Jesus*.

This Order has render'd itself very considerable by its Millions into the *Indies*, and by its other Employments relating to the Study of the Sciences, and the Education of Youth. — The Council of *Trent* calls them, *Regular Clerks of the Company of Jesus*.

It was in the Year 1538, that *Ignatius* having assembled ten of his Companions at *Rome*, chosen mostly out of the University of *Paris*, proposed to them to make a new Order. After this he presented the Plan of his Institution to *Paul III.* who appointed three Commissioners to examine it; upon whose Report the Pontiff confirmed the Institution, under the Name of the *Company of Jesus*, by a Bull in 1540. By this Bull, their Number was restrained to sixty; but that Restriction was taken away, two Years afterwards, by another Bull. The Order has been since confirmed by several succeeding Popes, who have added many new Rights and Privileges to it.

The End principally proposed by this Order, is, as pretended, to gain Converts to the *Roman Church*; with which View they disperse themselves in every Country,

and Nation. But they are accused (if very justly, is what I leave to the Judgment of the whole World) of making this holy Motive subservient to their own Interest, and of propagating their Grandeur, Ambition, Power, &c. under the specious Pretence of propagating the Gospel. It is even pretended, that in the *Protestant Countries*, where they are sent into Mission, they make a greater Number of Profelytes to *Protestantism*, in one Year, by their Supineness, Want of Charity, Calumnies, revengeful Spirit, Love of Money, and all hid under a great outward Shew of Religion, than the best *Protestant* Preacher can do in ten. It is true, that I have known some *Jesuits* guilty of those Crimes, and more in *England* than any where else; but I have, likewise, known a far greater Number of very worthy *Jesuits*, especially in other Countries, and I think it very unjust and barbarous to make a celebrated Congregation as that is, answerable for the Crimes of a few Particulars. If some of them have been suspected of having contributed to the Deposition of some Princes, and even to the Parricide of others, the whole Order had certainly no Hand in it: Even in the first Company of *Jesus*, there was a *Judas*, and the *Jesuits* who are guilty of the Crimes above-mentioned, are in all Appearance, the Disciples of that Traitor; since, like him, they consult nothing but their own Interest, and would sell their divine Master as he did, if they could find Purchasers.

Their Conduct in the *Indies* is also censured, under Pretence of having established their Empire there, instead of that of *Jesus Christ*; and of having made a monstrous and prophane Mixture of the Ceremonies of *Confucius*, with those of the *Christianism*. Though all this may proceed from the Jealousy of their Enemies; as well as what is rumour'd here at present, of their wanting to deprive an illustrious Family of a large Sum, because it was found in the Possession of one of the Society at his Death, though that Money is the Product of an Estate belonging to that Family; and the Conscience of the Heiress does not permit her to have Recourse to the Laws of the Realm, for a Redress; though I cannot help thinking her Conscience a little too scrupulous in that Case; and that that Money would be far better in her own Hands, which are always open for charitable Deeds, whereas those of the *Jesuits* are always shut to the Distressed; for if that Money falls in their Hands, it will be of no Benefit to the Publick, but if the good Lady has the Disposol thereof, her present extensive Charity gives us Hope, the greatest Part of it will be employ'd in feeding the Hungry, and cloathing the Naked. To remit the Decision of that Affair to the Court of *Rome*, is to give up her Right.

The *Jesuits* have the Politicks to receive no other Subjects among them, but those who are born either of an illustrious, or of a rich Family, or in whom they find a very great Disposition for the Sciences. For those of an illustrious Family introduce them at the Court of Princes, where there are always some of them seen, and render them formidable: The Rich increase their Store; and those of an extraordinary Merit heighten the Reputation of the Order.

The *Jesuits* have no particular Habit; but change and accommodate it to Time and Occasions.

The Order consists of five different Classes; *professed Fathers*, *spiritual Coadjutors*, *approved Scholars*, *Lay-Brothers*, called also *temporal Coadjutors*, and *Novices*.

The *professed Fathers*, who make the Body of the Company, take the three solemn Vows of Religion publickly; and to these add a special Vow of Obedience to the Head of the Church (which last Vow they observe while it suits their Conveniency, otherwise they make no Scruple of breaking it.) — The *spiritual Coadjutors* make also publick Vows of Chastity, Poverty, and Obedience; but omit the fourth relating to Millions, &c. *Approved Scholars* are those, who after two Years *Noviciat* have been admitted, and have made the three Vows of Religion; not solemn, indeed, but yet declared. They are in the Way to become *professed* or *spiritual Coadjutors*, according as the General thinks fit. — These Degrees, except that of *professed*, are never conferred till after two Years *Noviciat*, and seven Years Study, seven or Regency, a third Year of *Noviciat*, and thirty three Years of Age. The Vows of the Scholars are abso-

ture on their Side, but only conditional on the Side of the Order; the General having it in his Power to dispense with them.

The Order is divided into *Affistances*; the *Affistances* into *Provinces*; and the *Provinces* into *Houses*. It is govern'd by a General, who is perpetual and absolute; he resides at *Rome*, and is elected by a general Congregation of the Order. He has with him five Persons, who are, as it were, his *Ministers*; they are called his *Affistants*, and bear the Name of the Kingdom or Country to which they belong, and by whom they are appointed, viz. of *Italy, France, Spain, Germany, and Portugal*. To these belongs the Care of preparing the Matters of their respective *Affistances*, and of putting them in a Method to facilitate their Dispatch. It is by these, that both Inferiors and Superiors go regularly before the General. They are chosen by the Congregation, and are not only the General's Counsellors to assist him in his Business, but also to observe his Conduct; and, if they find Occasion, they may call a general Congregation without his Consent, who may depose him in Form; or they have it in their Power to depose him themselves, after having, by Letter, obtain'd the Suffrages of their *Provinces*.

Each Province has four Kinds of Houses, viz. *professed Houses*, which can have no Lands belonging to them; *Colleges*, where the Sciences are taught; *Residences*, where are a Number of Workmen, employ'd in such Offices as have any immediate Relation to Preaching, Confession, Missions, &c. and Houses of *Novices*.

Among the *Colleges*, there are some called simply *Colleges*, and others called *Seminaries*. These last are set apart for the young *Jesuits* to go through their Courses of Philosophy and Theology in; the others are for Strangers.

Each Province is govern'd by a *Provincial*, and each House by a *Superior*; who is called a *Rector* in the Colleges, and a *Superior* in other Houses. *Ignatius* regulated the Discipline of those Houses, especially of the Colleges, by what he had observed in the *Sorbonne*, while he studied at *Paris*.

The Professed of this Order, renounce by a solemn Vow, all Preferment, and especially Prelacy; and cannot receive any, unless enjoined thereto by the Pope, under Pain of Sin. This the Pope sometimes does; insomuch that they have had eight Cardinals of their Order.

Note, That the greatest Ornament of the *Society of Jesus*, was *St. Francis Xavierius*, justly stiled the Apostle of the *Indies*; who by the Austerity of his Life, a truly angelical Union and Energy of his Discourse, and by exposing himself to continual and innumerable Dangers, converted almost all *Japan* to Christianity, without procuring the least temporal Advantage either to himself or his Order; and died there the Death of the Elect, rather full of Merits than of Years.

The *Fathers of the Mission*, is also a Congregation of Priests and Lay-Men, instituted by *Vincent de Paul*, and confirmed in 1626, by Pope *Urban VIII.* under the Title of *Priests of the Congregation of the Mission*.

These profess to make it their whole Business to assist the poor People in the Country; and to this Purpose oblige themselves not to preach, or administer any of the Sacraments in any Town where there is an Archbishop, Bishop, or Provincial residing.

They are settled in most Provinces of *France, Italy, Germany, and in Poland*. At *Paris* they have a Seminary which they call the *foreign Mission*; where Youth are bred up, and qualified for *Missions* abroad.

The *Fathers of St. Lazarus*, called also *LAZARITES*, are certain regular Clerks of a Congregation, instituted in *France* in the seventeenth Century, by *M. Vincent*.

They take the Denomination from a House in the *Faubourg of Paris*. They have a Seminary at *Paris*, call'd *Le Seminaire des bons Enfants*; where young Rakes of Quality, or Burghers of *Paris*, are sometime shut up, to learn a better Course of Life, and undergo a severe Correction for their past Debaucheries; which Correction consists most commonly in severe and frequent Verberations of the Posteriors.

These Fathers have also the Direction in several of the Bishopricks of the Kingdom of *France*, of the Semi-

naries established to instruct young Clerks in all the Exercises of Piety, and prepare them for their Admission into Holy Orders.

The Habit of these Priests is not different from that of the secular Priests. They are govern'd by a General, who has his Assistants like that of the *Jesuits*. They are, in general, Persons of Merit, and of a very exemplary Life.

The *Theatins* are also regular Priests; thus called from their first Superior *Don John Pietro Caraffa*, Archbishop of *Chieti*, in the Kingdom of *Naples*, which was antiently called *Theate*.

The same Archbishop was afterwards Pope, by the Name of *Paul IV.* after having been a Companion of *Gaetan*, a *Venetian* Gentleman, the first Founder of this Order, at *Rome*, in 1524.

The *Theatins* were the first who assumed the Title of regular Clerks. They have not only no Lands or fixed Revenues, either in Common or in Propriety; but they do not even ask or beg any Thing; but wait for what Providence shall send them for their Subsistence.

They employ themselves much in foreign Missions; and in 1627, enter'd upon *Mingrelia*, where they have an Establishment: They have had the like in *Tartary, Circassia, and Georgia*, which they have since abandoned by Reason of the little Progress they made in the Conversion of those People.

Their first Congregation appeared at *Rome*, in 1524, and was confirmed the same Year by *Clement VII.* Their Constitutions were drawn up at a general Chapter in 1604, and approved by *Clement VII.* They wear the Priests Habit.

Note, That having thus given a concise historical Account of all the different Orders of Monks and Priars, ever since their first Institution, to this present Time; it is proper I should give next one of all the different Orders of Nuns, or religious Congregations of Women; beginning by the most antient, which in the West is that of the *Benedictine Nuns*.

The *Benedictine Nuns* follow the Rule of *St. Benedict*, except that they do not abstain from Flesh: They celebrate the divine Service in the same Manner the *Benedictines* do, and have the same Church-Musick. They rise at Two in the Morning to their Matins; and go to Church five times a Day.

Their Habit is black like that of the *Benedictine Monks*; except that in lieu of a Cowl, they wear a Veil, and under it a Cambrick Forehead-Cloth, which covers about a third Part of their Forehead; their Bosom being also covered with what they call a *Guimpe* of the same. This Habit is very noble, decent, and becoming.

Most of their Houses in *France* are royal Abbeyes, or Pories, at the King's Nomination.

The *Bernardine Nuns* follow the Reform of *St. Bernard*, and abstain from Flesh. Their Habit is white, with a black Scapulary, and a black Veil.

The *Fuillantines*, are still more reformed than the *Bernardines*, and follow the Constitutions of the *Fuillants*. In some of their Houses they undertake the Correction of Prostitutes, or debauched Women.

The *Clarisses*, or *Nuns of St. Claire*, follow the Rule of *St. Francis*, and was founded by *St. Claire*, even in *St. Francis's* Time.

Their Habit is a coarse grey Cloth; they wear no Linen, and go barefoot. They have no Revenues, but employ Lay-Brothers, called *Freres Chapeau*, because they wear a Hat, in lieu of a Cowl, to go a begging for them.

The *Dominican Nuns*, called in some Places, *Preaching Sisters*, are even more antient than the Friars of that Order; *St. Dominick* having founded a Society of religious Maids at *Pouilles*, some Years before the Institution of his Order of Men, viz. in 1206. Their Habit is like that of the *Dominican Friars*, white and black.

The *Norbetine Nuns*, in the first Monasteries built by *S. Norbert*, were only separated from the Men by a Wall: But in 1137, by a Decree of a general Chapter, this Practice was prohibited, and the Women removed out of those already built, to a greater Distance from those of the Men. Their Habit is all white, like that of the Men.

The

The *THEATINES*, are *Nuns*, under the Direction of the *Theatins*.

There are two Kinds of *Theatines*, under the Title of *Sisters of the immaculate Conception*, who form two different Congregations, the one engaged by solemn Vows, and the other only by simple Vows. Their common Foundress was *Ursula Benincasa*. Those who make the simple Vows are the most antient, and are called absolutely *Theatines of the Congregation*: They had their Rise at *Naples*, in 1583.

The others are called *Theatines of the Hermitage*: The whole Business of these are praying in Retirement, and an austere Solitude, to which they engage themselves by solemn Vows.

The *Theatines* of the first Congregation, take Care of the temporal Concerns of these last. Their Houses stand together, and communicate by a large Hall. Their Foundress drew up their Constitutions, and laid the Foundation of their House at *Naples*, but died before it was finished.

Gregory XIV. who confirmed the new Institute, under the Rule of *St. Augustin*, appointed that they should be under the Direction of the *Theatines*. *Urban VIII.* revoked this Article by a Brief in 1624, and subjected them to the Nuncio of *Naples*; but *Clement IX.* annulled this Brief, and submitted them anew to the *Theatines*, by a Brief in 1668.

The *URSULINES*, is an Order of *Nuns*, who observe the Rule of *St. Augustin*; and are chiefly noted for taking on them the Education of young Maids.

They take their Name from their Institutress *S. Ursula*; and are clothed in white or black. The *Ursulines* have spread exceedingly in *France*, &c. within these few Years. — Few Maids but are put out to School to them. They are all under the Jurisdiction of the Diocesan.

Note, One of the most celebrated Order of *Nuns*, is that of *Fontevault* in *France*, founded by *Robert d'Arbre Sec*, or *Arbricelle*, *Britanny*, according to some Authors, or of the little Province of *Perche*, according to others. This Man caused himself to be followed by a vast Number of Men and Women, who at first lived lovingly together; but the *French* Clergy, afraid, with much Reason, that that Mixture of Sexes, might be attended at last with some very great and frequent Inconveniencies, obliged *Robert* to separate his Female Profelytes from the Men; which he did with so much Reluctancy, that he made that Separation consist only in the Partition of few Walls; and order'd, contrary to the common Practice of all the Founders of religious Congregations, that the Men should be subject to the Women, and that the Abbets of *Fontevault*, should be the Superior of the whole Order, and admit both Men and Women to Profession; which has continued ever since. The Historians of those Times relate of *Robert*, that the better to practise the Virtue of Chastity, he laid a whole Night between the two prettiest Women of his Followers, and rose the next Morning as pure and undefiled as he went to Bed; this the Abbot *Henry*, in his ecclesiastical History, calls *Novum genus Martyrii*, a new Kind of Martyrdom. The Abbets of *Fontevault* is always either a Princess, or a Person of the first Quality, who has embraced the monastick Life. Monks, Religious, or what you will be pleased to call them, of *Fontevault*, do seldom any Thing else but eat, drink, and sleep; and are very little known, either in the Church, or the learned World.

Towards the Middle of the last Century, *F. Joseph le Clerc du Tremblay*, a *Capuchin* Friar, and sometimes Confident of Cardinal *Richlieu*, instituted a Congregation of *Nuns*, whom he called *Les Filles du Calvaire*, Maids of the Calvary, and to whom he gave the Rule of *St. Benedict*; and Constitutions, which, in several Particulars, are like those of his own Order.

These *Nuns* are clothed in black, rise at Two in the Morning to their Matins, abstain from Flesh, and are never seen by any Body, except their near Relations, after they have been admitted to Profession. They sing all their Offices, as the other *Benedictines* do, with a very great Decency, and their Musick is heavenly fine.

There are also *Nuns of the Visitation*; whose Rule

is not very austere. Their Habit is black, and they wear a Silver Cross hanging down on their Breast.

Most of the *Nuns*, called *HOSPITALIERS*, follow the Rule of *St. Augustin*, and are appointed to govern Hospitals, which they do with a great deal of Humanity and Compassion. Their Habit is white, with a black Scapulary and a black Veil.

The most celebrated Monastery of this Kind, is that of the *Hotel Dieu* at *Paris*, which consists always of a hundred professed *Nuns*, and fifty *Novices*. They attend the Sick Night and Day, having all the Wards of the Hospital distributed between them, where they relieve one another, and watch almost every Motion of the poor Patients committed to their Care, with a truly Christian Patience and Tendernefs, and without giving them the least angry Word; never refusing them what the House can afford, *i. e.* all they can ask for, if it be not prejudicial to their Health, or contrary to their Recovery.

Besides the above-mention'd different Congregations of *Nuns*, there are also *CANONESSES*, who are Women who enjoy a Prebend, affixed by the Foundation to Maids; without being obliged to renounce the World, or make any Vows.

There are few of these, except in *Flanders* and *Germany*: They are rather looked upon as a Seminary and Retreat of Girls for Marriage, than an Engagement for the Service of God.

CANONESSES of St. Augustin, or *regular Canonesses*, are a Kind of Religious, who follow the Rule of *St. Augustin*, of which there are various Congregations.

Note, That the 20th Canon of the second Council of *Nice*, in *Bitbynia*, held in 785, condemns the double Monasteries, *i. e.* where Men and Women inhabited together, as scandalous, and giving Occasion to Sin. They were very antient, and we learn from History, that there were such of the Rule of *St. Pachomius*, which were separated but by the River *Nile*. Pope *Gelasius* reprimands severely, in his Epistle to the Bishops of the March of *Ancona*, a *Pelagian* Priest, called *Seneca*, who wanted to introduce such. The Emperor *Justinian* separated them by a Law inserted in the Codex, because, says he, it procures Means to the Monks to converse at all Times with the *Nuns*. *Paschalis II.* writing to *Didacus* Archbishop of *Compostella*, says, that it is a Thing quite unbecoming, that in his Country the Monks should inhabit with the *Nuns*, and that he must abolish that bad Custom, and procure that they should lodge in different Houses. The Order of the *Norbertins*, as already observed, had at its Beginning these double Monasteries; and the Order of the *Cisterians*, which came afterwards, had the like, which multiplied much in *Brabant*, and in the Diocese of *Liege*. The Canon we speak of, excepts the Monasteries of *St. Basil*; and is willing they should subsist; but those Monasteries were so well regulated, that there was nothing to fear. The Council of *Basil* approved, likewise, the double Monasteries of *St. Bridget*, at the Request of *Erick* King of *Sweden*.

Note also, That in the 11th Canon of the Synod of *Seville*, held in 619, it is order'd, that the Monasteries of *Nuns* in the *Belbick*, shall be govern'd by Monks, because, say the Fathers of that Synod, we provide efficaciously for the Salvation of the Virgins consecrated to *Jesus Christ*, by appointing them spiritual Directors, who can not only defend them by their Conduct, but likewise instruct and edify them by their Doctrine and their Example.

In *Italy*, particularly, and in *France*, most of the *Nuns* are governed by Monks or Friars of their own Order; which notwithstanding several Monasteries of *Nuns* have asked the Popes to be free from that Government, which was granted them without Difficulty. The Reason is, that most of the Religious of these Times, have neither the antient Piety, nor the Learning necessary for the Government of *Nuns*; nor certain Meeknefs and Condescension, which they require. We have seen in *France* a great Schism on that Subject, among the *Carmelite Nuns*, some wanting to be govern'd by the bare-footed *Carmelite* Friars, according to the Constitutions of *St. Therese*; and others

thers wanting to remain under the Direction of particular Priests appointed by the Holy See. The Dispute went so far, that whole Convents of those Nuns quitted the Kingdom, and retired into *Flanders*, where they are govern'd by the *Carmelite* Friars.

But the same Canon which gives Monks for Superiors to Maids consecrated to God, orders that they shall be chosen amongst the oldest, and the most virtuous; forbidding them to have any Familiarity with them, to approach the Gate of the Monastery, and to speak to any but the Superior, who even then must be accompanied with two or three other Nuns; never speaking of any Thing else, but of what has Relation to the Preservation of the Institution.

Almost all the *Monks*, *Friars*, and *Nuns*, mentioned throughout this Treatise, should postulate a considerable Time before they are admitted into a Monastery; and those to whom they address themselves for their Admission, should paint to them, in the most vivid Colours, all that the *Order* they desire to be received into, has the most capable to deter young Minds from it.

When a *Postulant* is known a good Subject, the Monk or Friar he has addressed himself to, informs the Father Provincial of it, who sends the *Postulant* his *Obedience*, i. e. an *Order*, which he is to present to the Superior of the House, where he is to make his *Noviciate*, to receive him. That *Noviciate* lasts commonly a whole Year, which is called the *Year of Probation*, because the Novice runs then through all the Exercises of the Monastery, and learns the Rule he is to observe all his Life-time, if he happens to be a professed Monk.

The Year of Probation expired, if the Novice continues in his former Sentiments, all the Professed meet together, and consult among themselves, if the Novice be worthy of being admitted to make his solemn Vows; which is determined by the Plurality of Voices; and if the Novice has a Majority thereof, a Day is fixed for his solemn Profession; if not, he is turn'd out of the Monastery. And the same in Monasteries of *Nuns*.

The *Vows* made on that solemn Occasion are three, viz. of *Poverty*, *Chastity*, and *Obedience*.

Note, That Authors are divided as to the Antiquity of their *Vows*. It is agreed the ancient *Anachorets* and *Hermits* of the *Thebaide* made none; they did not consecrate themselves to God by an indissoluble Obligation, but were at Liberty to quit their Retirement, and return into the World, whenever the Fervour that drove them out of it came to abate. — *Vows* were not introduced till long after; and that to fix the too frequent Inconstancy of such as, after retiring from the World, repented too soon, or too slightly, and by that Means scandalized the Church, and disturbed the Quiet of Families by their Return.

Erasmus will have it, that solemn *Vows* were not introduced till the 13th Century, under the Pontificate of *Boniface VIII.* Others hold them as ancient as the Council of *Chalcedon*: But the Truth is, before *Boniface VIII.* there were none but simple *Vows*, and such as might be dispensed withal. Their *Vows* till that Time, were not deemed eternal Chains; they were not indissoluble. It is true they were obligatory Promises, as to Conscience, and the Inconstancy of such as violated them, was held an odious Desertion: But as to Law, the Persons were not held to be civilly dead, so as, upon their Return, to render them incapable of all Acts of civil Society.

The most common *Vow* was that of *Poverty*, but this only regarded the Convent; on Account of which, every Person divested himself of all Property: But the making of *Vows* did not at all exclude them from the Right of Blood, or render them incapable of inheriting. No Religious, it is true, acquired the Property of the Effects that fell to him; they all belonged to the Monastery, in favour of which he had divested himself of every Thing; and the Monastery only left him the *Usu-fruits* and Direction of them. The Popes have frequently confirmed this Privilege to divers Orders, and permitted the Monks to inherit, as much as if they were Seculars, and had made no *Vows*. At present the civil Death of a Religious is dated from the Day he makes the *Vows*; and from that

Time he is utterly incapable of inheriting. A Religious may reclaim or protest against his *Vows*, within five Years; but after that it is no longer admitted. The Failures in the Profession, are esteemed to be purged, by his Silence, and Perseverance for five Years. Indeed to be relieved from his *Vows*, 'tis not enough the Party reclaim within the five Years, but he must likewise prove he was forced to take the Habit. Tho' a Religious, of an austere Order, on Account of his ill State of Health, which renders him incapable of observing the Rule of the Order he is enter'd into, may, with a Dispensation from the Pope, pass into a more mitigated Order, which is stiled *ad Laxiora*.

For my Part, I will not pretend to condemn the monastical *Vows*, on the contrary, I am of Opinion, that solemn *Vows* are sacred, and were considered as such even among the *Pagans* themselves; it was always permitted, in all Sorts of Religions, to consecrate one self in a particular Manner to the Service of God; but then I would have that Consecration made, with mature Deliberation, and in an Age where he that consecrates himself knows what he does, without following the first Movements of an indiscreet Zeal; and in an Age, where even the civil Law does not think a Person capable of being his own Master, in temporal Affairs, so as to manage them without the Direction of a Tutor. For if a Man or a Woman is not accounted to have Judgment or Discretion enough to make Choice of a settled State in the World, or to enter into civil Engagements, how can they be permitted to oblige themselves by the most solemn Protestation, to follow a Kind of Life, and that without being permitted ever to quit it afterwards, on any Consideration whatever, when Reason has quite open'd their Eyes, and made them repent of their Choice? It is true, that the Council of *Trent* has in some Measure remedied Part of the Abuses committed in these Cases; for before that Council, Children were shut up in a Monastery, almost from their Cradle, and obliged to embrace the monastick Life, without consulting their Inclination; and before they knew any Thing of another: But even since the Sanction of that Council, is sixteen Years accomplished, a fit Age to embrace a Profession for one's Life? Can one know what he does, when he is supposed not to know himself yet? Does not a Child at that Age (for he is then no other but a Child) who follows the too great Impetuosity of his Passions, deserve Correction? Why then should he be permitted to follow the Impetuosity of an indiscreet and fiery Zeal, which a few Years more of Experience, and a more free Use of his Reason, will, in all Likelihood, disapprove, and perhaps condemn. I would not have the Gates of Monasteries quite shut against all Sorts of Persons, without Distinction; but I would not have them open but to those only who have had a long Experience of the World, and quit it, either because they have discovered the Vanity thereof, or to repent, in a solitary Life, of the Faults they have committed in it. Thirty or forty Years would be a very good Age to embrace such a Kind of Life; for then a Man is capable to make such a Choice; otherwise it is captivating Man's Liberty, which God designed we should enjoy in its full Extent. It is true, that if this wholesome Rule was observed, the Monasteries would be neither so numerous, nor so well filled as they are; but then they would perhaps be kept in a better Order; and the Monks and Friars would not repent so soon, nor be so ready to desert their Monastery on the first favourable Opportunity, to the great Scandal of the monastick Life. Besides, would it not be more honourable, and more agreeable to the Intention of the Founders, to have a small Number of Religious, who would be contented with their Profession, than to have a vast Number of them, the greatest Part whereof repent of the Choice they have made? For as they were too young to know any Thing of the World, when they entered the Monastery, when they begin to have an entire Use of their Reason, they imagine, on what they hear and see of it, that it has many more Charms than it has in Reality, and therefore wish to return into it; which some of them do

by a clandestine Desertion of their Monastery, which the World itself considers as a Crime; and where they can scarce live publickly without Scandal; though God, who cannot approve those indiscreet Vocations, may look on those Flights with an Eye of Compassion, and procure some Means to those Deserters, to make Attonement for it, otherwise than by returning to their Monastery, where they are sure to meet with a very severe Punishment, exposed perhaps to end the Remainder of their unfortunate Days in Despair.

What I say here of Men must be likewise understood of young Girls, who are forced into a Convent, either because they have no Fortune to procure them an honourable Establishment in the World; or Nature has not been favourable to them; and they are shut up there to hide their Imperfections, or Deformities; for those Sacrifices to God are not always made of a Victim without Spots or Imperfections; for commonly the Parents offer to God those of their Children, whom they imagine the World would refuse; but were they to follow the Dictates of Nature, and the Principles of a Christian Equity, they should offer none but those who offer themselves voluntarily, nor even suffer they should offer themselves, till they are capable to do it; for those forced Vocations, or which proceed from want of Reflection, Disappointments, or any other indiscreet Motives, are not at all agreeable to God, and rather renders Salvation uncertain than ascertain it. So many Monasteries which swallow up the Fortune of Families, or are otherwise oppressive to the Publick, is a great Obstacle to the Reunion of several Nations in the same Faith. Let it be granted that the Monks and Nuns pray for us; but their Prayers do not dispense us from praying ourselves, therefore it seems, that it is in some measure needless to hire others to do it. If we be obliged to practise a Christian Charity, we see daily a great many Objects thereof, who are much more worthy of it than those who live in a holy Indolence; though I would not have Religious deprived of a decent Subsistence, but their Number should be limited, and a Competency allowed for such a Number; and what remains of their immense Revenues applied to better Uses; Part to ease the Subjects of some of their most heavy Taxes, and Part for the Maintenance of the Poor, and the Education of Orphans, and other Children born in Indigency. Of what Service is it to me to have the Name of my Ancestors chronicled in the Archives of Monasteries, under the fastuous Title of *Benefactors*, if I am reduced to Beggary, and want the Necessaries of Life?—An indiscreet Zeal throws sometimes a Man into a Monastery, who had perhaps served his Prince and Country with Reputation, either in the Armies, in the Cabinet, or in the Administration of Justice; and renders several Maids very bad Nuns, who had been very good Mothers of Families. Myself have known Nuns, whose Cloister was a frightful Prison for them, and whose Life was a continual Torment; and others who led in their Monastery an angelical one.

Note, also, That from this historical Account of the Religious, I'll pass to that of the military Orders; therefore,

Military ORDERS, are Companies of Knights, instituted by Kings and Princes; either for Defence of the Faith, or to confer Marks of Honour, and make Distinctions among their Subjects.

The *Military Orders*, instituted in Defence of the Faith, are called *religious military Orders*.—Of this Kind are the *Knights of St. Sepulchre*, of *Malta*, or of *St. John of Jerusalem*. Such were also the *Knights Templars*, the *Knights of Calatrava*, *Knights of St. Lazarus*, and the *Teutonic Knights*, &c.

The *Knights of MALTA*, is an Order of military Religious, who have bore various Names, as *Hospitalers of St. John of Jerusalem*, *Knights of St. John*, *Knights of Rhodes*, *Order of Malta*, *Religion of Malta*, &c.

About the Year 1048, some *Neapolitan Merchants* founded a Church after the *Latin Rite* at *Jerusalem*, giving it the Name of *Sancta Maria della Latina*. They also founded a Monastery of Religious, after the Order

of *St. Benedict* for the Reception of Pilgrims; and afterwards an Hospital near the Monastery, to take Care of the Diseased under the Direction of a Master or Tutor, to be nominated by the Abbot of *Sancta Maria della Latina*. Besides which they also built a Chapel in honour of *St. John Baptist*.

In 1099, *Godfrey de Bulloign* having taken *Jerusalem*, endowed this Hospital with some Demesnes he had in *France*; and others imitating his Liberality, the Revenues of this Hospital became considerably augmented. Upon this *Gerard Tern*, their Rector, in concert with the Hospitalers, resolved to separate from the Abbot and Religious of *Sancta Maria*, and to form a distinct Congregation, under the Name and Protection of *St. John Baptist*: And hence it was that they had the Name of *Hospitalers*, or *Brothers of St. John of Jerusalem*.

Pope *Paschal II.* by a Bull in 1113, confirmed the Donations made to this Hospital, which he settled under the Protection of the holy See; ordering that the Rector, after *Gerhard's* Death, should be chosen by the Hospitalers. *Raymond du Puy*, *Gerhard's* Successor, took the Title of *Master*; he gave a Rule to the Hospitalers, which was approved by *Calixtus II.* in 1220. Such was the first Rise of the Order of *Malta*.

Their first grand Master, finding the Revenues of the Hospital vastly to exceed what was necessary for the Entertainment of poor Pilgrims and diseased Persons, resolved to employ the Surplus against the Infidels; and with this View offered himself to the King of *Jerusalem*.

He divided his Hospitalers into three Classes: The first consisted of Nobles, whom he destined to the Profession of Arms, for the Defence of the Faith, and the Protection of Pilgrims; the second consisted of Priests or Chaplains, who were to say Mass; and the third of Servitors, who were not Nobles, but were also appointed for the War. He also regulated the Manner of admitting Knights Brothers; and had the whole confirmed by Pope *Innocent*; who gave them for Arms a White Cross in a Field Argent, which continues still the Standard of this Order.

After the Loss of *Jerusalem* they retired; first to *Margath*, then to *Acre*, which they defended very vigorously in 1290. After the entire Loss of the holy Land, they withdrew to *Cyprus*, where King *Henry of Lusignan*, whom they had followed thither, gave them the City of *Limisson*. Here they continued 18 Years; when taking the Island of *Rhodes* from the *Saracens* in 1308, they settled there. And now it was that they first took the Name of *Knights*, viz. *Knights of Rhodes*.

Andronicus, Emperor of *Constantinople*, granted to their grand Master, *Fulk de Villaret*, a *Frenchman*, as was the first *Raymond du Puy*, the Investiture of this Order; and the Donation was confirmed by Pope *Clement*. The Year following, with the Assistance of *Amadeus IV.* Duke of *Savoy*, they defended themselves and their Island against an Army of *Saracens*. In 1480, their grand Master *d'Aubusson*, a *Frenchman*, made a vigorous Defence against *Mahomet II.* Emperor of the *Turks*, and preserved the Island in Spite of a formidable Army, which besieged it for the Space of three Months. But in 1522, it was attacked by *Soliman the Magnificent*, with an Army of 300,000 Men, and taken at last by the Treason of the Treasurer of the Order. *Villiers l'Isle Adam*, a *Frenchman*, being then Grand Master, whose great Valour *Soliman* himself commended, in the most generous Terms deploring his unhappy Fate, and offering him all that was in his Power to make it better, which *l'Isle Adam* generously refused. *Rhodes* had been in the Knights Possession 213 Years.

After this Loss the Grand Master and Knights retired first into the Isle of *Candia*: Some Time after Pope *Clement VII.* gave them *Viterbo*; lastly, the Emperor *Charles V.* in 1530 gave them the Island of *Malta*, which they still hold, whence it is impossible to dislodge them; and hence they come by the Appellation of *Knights of Malta*; though their proper Name is that of the Order of *St. John of Jerusalem*; and their Grand Master, among his other Titles, still retains that of *Master of the Hospital of St. John, and Guardian of the Poor of our Saviour Jesus Christ*.

The Order of *Malta* have no other Domination besides their Island; and some other little Places in the Neighbourhood

bourhood, the Chief whereof are *Gaza* and *Comino*.

The Government is both Monarchical and Aristocratical, the Grand Master being Sovereign, and the Chapter the Senate.—It is Monarchical with regard to the Inhabitants of *Malta*, and the Isles adjacent, and even with regard to the *Knights*, in every thing relating to the Statutes and Rule of their Order: And Aristocratical, with regard to the Decision of any important Affairs, which are not to be dispatched but by the Grand Master and the Chapter.

There are two Councils; the one ordinary, composed of the Grand Master as Chief, and the grand Crosses; the other compleat, consisting of the Grand Master, the grand Crosses, and the two senior Knights of each Language.

By the *Languages* of *Malta*, are meant the several Nations whereof the Order is composed, viz. *Provence*, *Auvergne*, *France*, *Italy*, *Aragon*, *Germany*, *Castile*, and *England*: Therefore *France* has three of those Languages, viz. *Provence*, *Auvergne*, and *France*.

The *Pillar* (as he is called) of the Language of *Provence*, is the grand Commander of the Order: He of *Auvergne*, the grand *Mareschal*: He of *France*, the grand *Hospitaller*: He of *Italy*, grand *Admiral*: He of *Aragon*, grand *Conservator*, or *Draper*, as he was anciently called: The *Pillar* of the Language of *Germany*, is grand *Bayliff*: And he of *Castile*, grand *Chancellor*: The Language of *England*, which has been extinct since the Time of the Reformation under *Henry VIII.* had for his *Pillar*, or Chief, the grand *Turcopolier*, or Colonel of the Cavalry.—The Language of *Provence* is the first, on account of *Raymond du Puy*, their first Grand Master, who was a Provincial.

In each Language, there are several grand *Priories*, and capital *Bailiages*; the Kingdom of *France* alone having six of them, viz. the grand *Priory* of *Provence*, the grand *Priory* of *Auvergne*, the grand *Priory* of *France*, the grand *Priory* of *Aquitaine*, the grand *Priory* of *Champagne*, and the grand *Priory* of *Thoulouse*.

To each Language belongs a Hall, called *Auberge*, where the Knights eat, and hold their ordinary Assemblies: Each grand *Prior* has a Number of *Commanderies*.

The *Commanderies* are either magisterial, by Right, or by Favour: The *Magisterial* are those annexed to the Grand Mastership, whereof there is one in each grand *Priory*: *Commanderies by Right*, are those which come by Right of Seniority; their Seniority is computed from the Time of their Admission, but they must first have lived five Years at *Malta*, and have made four *Cara-vannes*, or cruising Voyages on the *Turks* and *Corfairs*: *Commanderies by Favour*, are those which the Grand Master, or the grand *Priors* have right to confer; one of those they confer every five Years on whom they please.

The noble *Knights*, are called *Knights by Right*; excepting whom, none can be *Bailiffs*, grand *Priors*, or Grand *Masters*.—*Knights by Favour* are those who, not being noble of themselves, are raised on account of some great Exploit, or notable Service, into the Rank of Nobles.

The *Servitors*, or *Serving-Brothers*, are of two Kinds: 1. The *Servitors of War*, whose Functions are the same with those of the *Knights*. 2. *Servitors of Religion*, whose whole Business is to sing the Praises of God in the conventual Church, and to officiate each in his Turn, as Chaplain on board the Vessels and Gallies of the Order.

The *Brothers of Obedience* are Priests, who, without being obliged to go to *Malta*, take the Habit of the Order, make the Vows, and attach themselves to the Service of some of the Churches of the Order, under the Command of a grand *Prior*, or Commander, to whom they pay Obedience.

The *Knights of Majority*, are those who, according to the Statutes, are admitted at sixteen Years of Age.

The *Knights of Minority*, are those who are admitted from the Time of their Birth; which however cannot be done without a Dispensation from the Pope.

The Chaplains can only be admitted regularly from ten to fifteen Years of Age; after fifteen, they must have a Brief from the Pope; till fifteen, the Grand

Master's Letter is sufficient: Those are called *Diacos*, and must give Proof of their being born of creditable Families.

For the Proofs of Nobility to be made, ere the Admission of *Knights*, in the Language of *Germany*, they go back six Generations; in the rest it is sufficient to go back to the great Grandfather, on the Father's, and Mother's Side.

The *Knights*, at their Profession, make the three Vows of Poverty, Chastity, and Obedience, in common with all other Religious, and a fourth of never making Peace with the Infidels; tho' they seldom observe any other but the two last.

After their Profession they are obliged to wear a white Cross, or Star with eight Points, sew'd on the Cloak, or Coat on the left Side, which is the proper Habit of the Order. The *Knights* who have not made their Vows, wear a gold Cross with eight Points, enamelled with white, and hanging at a black Ribband.—A Knight may defer making his Vows as long as he pleases, but then he is entitled to no *Commanderies*; and he seldom makes them till he be sure of a *Commandery*.

The *Grand Mastership* is for Life, and great Cabals are at his Election, each Language endeavouring to promote one of theirs; but as *France* has the greatest Number of Languages, and the greatest Number of *Commanderies*, there have been more Grand Masters of that Nation, than of all the others put together.

When *Malta* is menaced by the *Turks*, the Grand Master calls all the Commanders and Knights to the Assistance of the Order, who are obliged to obey, unless they can alledge some valuable Excuse to the contrary.

The Grand Master sends Embassadors to all the Courts of *Europe*, who profess the *Roman* Religion, who are received and treated like Embassadors of crowned Heads.

The Dean of *St. John's* Church at *Malta*, officiates pontifically, with the Mitre, and Crosier, though he be not a Bishop.

This illustrious Order is the Bulwark of Christendom, and have often made the *Ottoman* Empire tremble.

Note, That here follows an Abridgment of the *Statutes* and *Canons* of the Order of *St. John of Jerusalem*, made by their Grand Master *Raymond du Puy*, translated from the *Latin* Original.

' I *Raymond Pogge*, Servant of the Poor of *Jesus Christ*, and Guardian of the Hospital of *Jerusalem*, after a mature Deliberation with my Brethren, with their Consent, and with that of the whole Chapter, I have confirmed the following Articles in the House of the Hospital of *St. John Baptist of Jerusalem*.'

I. Each Brother received in this Order, and has given his Name in it, shall keep the three Vows, viz. of Chastity, Obedience, and voluntary Poverty, without having any thing in proper.

II. He'll fight for the Christian Religion and the divine Worship: He'll take always the Defence of a just Cause, and give Assistance to those who are oppressed: He'll make Incursions against the Pagans, Infidels, and *Mahometans*, by the Example of the *Maccabees*, who gave no Quarter to the Enemies of God's People: He'll apply himself to the Practice of all the Christian Virtues: He'll defend the Widows and Orphans, and those who will transgress this Rule, shall be subject to a temporal and eternal Punishment.

III. This Rule shall be read in Presence of all the Brethren, at the Day appointed for the Assemblies, which are kept every Quarter of a Year.

IV. Whoever shall be loaded with Debts, and engaged in the Service of some other who has a Right over him, shall not be admitted into this Order; and though some body had been flattered by some of the Brethren with the Hope of receiving the Cross, he notwithstanding, before he receives the Knight's Habit, must be examined to know if he has not given his Name to some other Order, and if he has not contracted some other Engagement, like that of Marriage; for if he has contracted any he must not be received into the Order.

V. His Cloaths of Knight shall be of a brown Colour, and distinguished on the Left-Side by the Sign of a white Cross; and these will be his common Cloaths in Time

of Peace ; but in Time of War, when he takes the Field, his Habit shall be Red with a white Cross.

VI. No illegitimate Children shall be admitted into the Order, except the natural Children of Persons of a high Rank, provided their Mother has not been a menial Servant.

VII. All those born or descended from a Race of Infidels, as of *Marans, Jews, Saracens, Mahometans, Turks*, and the like, shall be absolutely excluded from the Order : Which must be understood likewise of Children of Princes, let their Birth be ever so illustrious.

VIII. Likewise these who have engaged their Faith in another Order, or in the State of Marriage, who are guilty of Homicide, or other enormous Crimes, shall not enter this Order.

IX. He that desires to be received into the Order, must be at least thirteen Years of Age, healthy, vigorous of Body, and sound of Mind, have noble Inclinations, and be naturally patient in Toils and Adversities.

X. Before he enters the Order he shall make his Proofs of Nobility, before those appointed by the Prior or Chapter, at the usual Convent ; for after he has been once received he is free from Enquiries, as well for his Nobility as for his past Life.

XI. All the Brethren shall assist constantly at divine Service, and instead of the seven canonical Hours established among Regulars, they shall recite a hundred and fifty Times the Lord's Prayer ; they'll fast at the Day appointed : They'll receive the blessed Sacrament of the Eucharist thrice a Year, and always at the solemn Feasts of *Christmas, Easter*, and of the *Pentecost*.

XII. Each Knight shall, before he goes to Sea for the Service of his Profession, confess to a Priest, and after he has cleared his Conscience, he shall think no more of his temporal Affairs, to which he must have provided by Testament or any other Means.

XIII. At the Time of divine Service, they shall not approach in the Choir too near the Altar, where they could hinder the Devotion of one another.

XIV. They'll keep their Rank, either for Precedency or for the Place they must have, according to the Order of their Reception.

XV. They'll make, at certain Times, Pilgrimages with Devotion, where they'll pray God, for Peace and Concord among the Christians, and that he be pleased to bless the Grand Master, and the whole Order.

XVI. Thirty Masses shall be celebrated for every Brother deceased ; and each Knight shall offer a lighted Taper, with a Denier.

XVII. There shall be preaching in the Convent during the whole Time of the *Advent* and *Lent*.

XVIII. They shall not engage themselves by Oath to any body. They shall not fit out any Men of War, unknown to, and without the Consent of the Grand Master. In case of a War between two Christian Princes, they shall espouse the Party of neither, but use all their best Endeavours to procure Peace and Concord between them.

Note, That here follows likewise an Abridgement of some Privileges granted to the *Order of Malta*.

I. The Disobedient, or those in Debt, are to be deprived of their Honours.

II. Those that have obtained the Cross of the Order of Knights, and have been named to some Office, shall indispensably appear when summoned, to receive the Marks of the Order on their Cloaths, and the Offices they have been promoted to, and that within six Months.

III. Those only can enjoy the Privileges of the Order, who have receiv'd the Cross from the Grand Master, or from some other by his Order.

IV. All those are excluded from the Benefit of the Privileges of the Order, who of their own Accord, and to indulge themselves, are Vagabonds in the World, and do not assist the Religion with their Services, according to the Engagements they are enter'd into by their Profession.

V. However, through an extreme Necessity, or by some unexpected Accident, has took Sanctuary in any of the Churches of the Order, shall not be taken from them by Force.

VI. All those born of an Adultery shall not be re-

ceived into the Order, unless they be Children of Persons of a high Rank.

VII. The Knights are allowed to exercise themselves in the secular Way, to give Marks of their Courage, or learn to imitate others.

VIII. The Knights are granted a full Power to administer Justice, to take Cognizance, and decide Causes, to execute Sentences, &c. So that it is not even permitted to Clerks to have Recourse to any other Tribunal than that of *Malta*.

IX. They cannot ask for another Magistrate, nor appeal to another Tribunal, unless they want to appeal from a former Judgment, to the Grand Master and his Council, and from thence to a Chapter of the whole Order, where all Affairs are terminated *in dernier ressort*.

X. The Grand Master and the Convent shall have full Power to execute all his Decrees, Sentences, Deeds, &c. in any Place whatever, without being obliged to ask the Consent of any other Person.

XI. The Grand Master has the Power to arrest, and punish the Priors and other Brothers of the Order, who have committed some Offence, or have shewn themselves refractory.

XII. The Knights that have received the Habit of the Order, either in the Convent, or in some other Place, and who are absent, are obliged before the End of the Year to appear in the Convent, otherwise they are punished, or deprived of some other Advantages.

XIII. The Knights that have a certain Portion of Revenue, assigned to them at *Malta*, or any where else, are obliged to appear when summoned by the Grand Master, under Penalty of being deprived of their Immunities.

XIV. The Presidents of the Chamber of Accounts, or the *Archimandrites*, and Priors of the Commonalties, can in virtue of their Office, for the common Good of the Order, appropriate to themselves, in any Place whatever, and enter into Possession of all the Farms or other Estates, which are mortgaged to the Order for Debts.

XV. The Cardinals themselves of the *Roman Church*, that have the Ufu-fruit of some Estates belonging to the Order, cannot, under what Pretence soever, dispense themselves from Paying to the Chamber of St. *John* the Revenue of what is owing to it.

XVI. Those that have accepted Offices, or farmed Estates of the Order, are obliged to take the Habit of Knight, under the Penalty of forfeiting their Rights.

XVII. The Officers of Justice, as well those of the first, second, as of the last Order, shall protect the Order, in the Preservation and Recovery of all the Priories, Commanderies, and other Estates belonging to it, till they have received a full and entire Satisfaction.

XVIII. The Island of *Malta* shall remain under the Protection of the Apostle St. *Paul*, its Patron.

XIX. To the Grand Master, and to his ordinary Consistory, belong all Offices, Benefices, and Honours.

XX. The Clergy of *Malta* has not the Power to deprive any Knight of his Rank of Honour, but such Things must be done by the Grand Master's Order.

Note, That I'll add to these the Ceremonies observed in giving the *Habit* to the Knights, and in admitting them to Profession ; the Form of the Habit, &c. — Likewise those used at the Election of the Grand Master, the Form of his Habit ; and the Chronology of all the Grand Masters, ever since the first Institution of the Order ; when each Grand Mastership began, how long it lasted, and when it ended.

The Ceremonies observed in giving the *Habit* of the *Order of Malta*, are these. — The *Postulant*, or Candidate, having obtained Leave of the Grand Master, and of the Council to take the Habit, and be admitted to Profession ; the Day having been fixed, he comes to Church, where kneeling before the Altar, dressed in a long Gown, and Cloak, which is the Habit of the Order, holding a Taper in his Hand, he offers the Priest his naked Sword to be blessed. The Priest holding it naked tells him, *Receive this blessed Sword in the Name of the Father, and of the Son, and of the Holy Ghost, Amen And use it for your Defence, and for that of God's Church, to the Confusion of the Enemies of the Cross of Jesus Christ, and of the Christian Religion.* and the

Care, as much as human Frailty will allow it, to strike no Body with it unjustly. May the Grace of using it thus be granted to you, by him who lives and reigns with the Father and the Holy Ghost, for ever and ever, Amen. Afterwards the Sword is return'd into the Scabbard, and the Priest fastens it at the Side of the Knight, that is to be admitted to Profession; telling him, *Put your Sword on your Side, and remember that it is not so much by Arms, that the Saints have conquered Kingdoms, as by their great Faith.*

This done, the Priest kisses the Knight on the Cheek, and he is fit to be admitted to Profession, which is performed in the following Manner.

The Knight kneeling, and holding in his Hand a Taper of white Wax lighted, to which is commonly fastened a Gold Crown, the Priests ask him if he be ready to promise, not by Word of Mouth only, but from the Bottom of his Heart, all the salutary Advices which have been given him; to which the Knight, who makes Profession, answers, *I. N. Swear and promise to Jesus Christ, who is God, to the blessed Virgin Mary, to St. John Baptist, that I'll use all my best Endeavours to observe punctually those Things.*

Before the Priest reads the Gospel, the Knight who is to receive the Vows of the Professed, says to him, *What do you ask?* To which the other having answer'd, that he asks the Order of Knighthood; he says to him again, *Have you ever received it from any Prince, or other Person who had Power to give it?* The Professed having answered what he thinks fit, the Knight continues to say to him, *It is a noble and salutary Thing to serve the Poor of Jesus Christ, to practise the Works of Mercy, and to consecrate oneself to the Service and Defence of the Faith. But however, you ask a Thing which several others have asked, and desired, and could not obtain. For this Order of Knighthood you ask, is commonly given to those, who for the Antienty of their noble Descent deserve it, or have rendered themselves worthy of it by their proper Merit. Wherefore knowing you such a one as the Order of Knighthood requires, we grant your Request, putting you in Mind that those to whom it is granted to receive this Order, are obliged to be Defenders of the Faith, of the poor Widows, and of the Orphans; do you promise to be such?* To which having answered, *I do, Sir;* the Knight gives him the Sword in the Scabbard in his Hand, telling him at the same Time, *To the End that you shall maintain what you have promised, take this Sword in the Name of the Father, of the Son, and of the Holy Ghost, Amen.* The Knight drawing the Sword afterwards, and giving it to the Professed, tells him, *Take this Sword, which by its Brightness, is inflamed with Faith, by its Point with Hope, and by its Hilt with Charity, of which you'll use virtuously, in your own Defence, and of the Catholick Faith, and you shall not fear the Perils and Dangers for the Name of God, for the Sign of the Cross, and for the Liberty of the Church; maintaining Justice, and comforting Widows, and poor Orphans, for that's the true Faith, and Justification of a Knight, &c.*

The Knight bids the Professed to clean, and rub the Sword on his Arm; then put it back into the Scabbard, saying to him, *So as you put that Sword clean, and polished into the Scabbard, you must not defile it by striking any Body unjustly with it, but employ it as above; God grant you to do it, Amen.*

The Professed still kneeling, and holding the Sword in the Scabbard, the Knight takes it from him, and girts him with it, saying, *I girt you with this Sword in the Name of the Almighty God, of the glorious Virgin Mary, of St. John Baptist, and of the glorious St. George, in whose Honour you receive the Honour of Knighthood, &c.*

The Professed rises afterwards, holding his Sword naked, which he brandishes three Times, and the Knight says to him, *These three Times you have brandished your Sword, signify, that in the Name of the blessed Trinity, you have Power to challenge all the Enemies of the Catholick Faith, with Hope of Victory; may God grant it to you, Amen.* The Professed cleans his Sword afterwards, and puts it into the Scabbard; and the Knight having drawn it, he strikes him with it three Times on the Shoulder, saying to him, *I make you a Knight in the Name of God, of the Virgin Mary, of St. John Baptist, and of St. George, be vigilant and pacifick, in Honour of Knighthood;* then puts again the Sword

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in the Scabbard, and looking on the Professed, he gives him a gentle Slap on the Face, saying, *Awake, and be not drowsy in Business, but watch in the Faith of Jesus Christ, and let this be the last Affront or Shame you'll receive for the Cause of Jesus Christ, having the Peace of our Lord within you.*

He shews him afterwards the gilt Spurs, and says, *See these Spurs; they signify to you, that as the Horse fears them, while he neglects his Duty, thus you must fear coming out of your Ranks and Vows, and doing evil: They are put gilt on your Feet, because Gold is the richest Metal, and the Emblem of Honour.* Another Knight fastens them to his Feet, and then he returns to his Place, to continue to hear Mass.

As to the Manner of giving the Habit and Cross of the Order of St. John of Jerusalem. — The Professed having requested to be admitted into the Company of the Brothers of the holy Religion of St. John of Jerusalem: He that receives him says to him, *The Favour you ask has been refused to others; but we confiding in your Probity and Sufficiency, are determined to grant it to you, hoping with a good Zeal and Charity, that you exercise yourself in Deeds of Compassion, and entirely in the Service of the Hospital of this Religion, not only enriched, and amplified with many great Privileges, Freedoms, Franchises, and Immunities, by the holy apostolical See, &c. Therefore I am obliged to let you know here, in Presence of all the Assistants, and ask you if you be entirely willing to observe the Rule thereof; if so you must be prepared henceforward, to bear with Patience all the Troubles and Difficulties you'll meet with in the Service of our Religion, and entirely divest yourself of your own Will, resigning it this Day into the Hands of all the Superiors placed in it, commanding you to obey them in all Things.*

The Professed having answer'd that he is content; he that receives him commands him to go, and take the Missel from off the Altar, and bring it to him; and making him put his Hands on the Canon of the Mass, the Professed pronounces his Vows in the following Manner. *I. N. Vow and promise to God Almighty (to the glorious Virgin Mary, to St. John Baptist our Patron) with the Assistance of his Grace, to observe and keep true Obedience to him, who shall be order'd by God, and my Religion, to live without Property, and to keep Chastity, as it becomes all good Catholick Religious.* Then he that receives him continues, *Now we acknowledge you for one of the Defenders of the Catholick Church, and for a Servant of the Poor of the Hospital of St. John of Jerusalem.*

This done, he that receives, takes the Mantle, shews the Cross to the Professed, and makes him kiss it, saying, *Take this Cross, and Habit, in the Name of the blessed Trinity, where you'll find Peace and the Salvation of your Soul, for the Increase of the Catholick Faith, and the Defence of good Christians, for the Honour of our Lord Jesus Christ; and therefore I'll put this Cross on your left Side near the Heart, &c. You'll be obliged to recite every Day a hundred and fifty Pater-Nosters, or the Hours of the blessed Virgin, or the Vigils of the Dead. You'll be likewise obliged to recite one of the three Forms of Prayers above-mentioned for each of our Brethren deceased, and remain bare-headed, till the Master commands you to put on your Hat; and after the Collect and Blessing of the Priest, you'll embrace all the Brothers, and make your Obedience to the Hall, before you go to Dinner.*

Note, That next follows the Ceremonies observed at the Election of a Grand Master.

When the Grand Master falls sick, the Seal, all the secret Letters, and Ornaments are carried off, and secured; if the Malady grows worse, and is judged mortal; they are put in the Hands of the Grand Jusiciary, who takes, then, the Conduct of the Order.

When the Grand Master is dead, a Lieutenant is chosen, who has the Regency till another Grand Master is elected. Afterwards the Chapter-General is assembled, where Measures are taken for the approaching Election. The next Day the Bell is rung, to have it assembled again in the Church of St. John, which is the Place appointed for the Election. While the Assembly holds, the Gates are shut, and no Knight is permitted to assist there with his Arms. That Assembly must be composed of the eight Languages or Nations, each whereof is composed of its Priors, Bailiffs, Grand-Priors, great Crosses, Knights

Knights, Priests or Chaplains, &c. they take altogether the usual Oath before the Lieutenant, and the whole Chapter, on the Cross of the Order which they wear on their Cloaths, and the Lieutenant is the last to take the Oath. Afterwards it is declared to the Orator or Speaker, that the Chapter is assembled for the Election of a *Grand Master*.

The Election begins by three Persons, a Knight, a Chaplain, and a Servant at Arms; they give their Votes with an entire Freedom, and choose eight Brothers of Election of the eight Languages, which is done by Balots put in a little Box which shuts, whereby the Votes are collected, those who are elected, taking the Oaths immediately. Which done, they withdraw from the Assembly into a particular Place, where they choose a Commander of Election, of which they inform immediately the Lieutenant, and the whole Assembly; then the new Commander approaches, kneels down, and takes the Oaths before the Lieutenant, whose Authority ends at that Instant, and the new Commander becomes Chief, and President of the whole Order. At the same Instant the eight Elects above-mention'd, come likewise to take the Oath, that they'll choose three other Brothers, worthy Subjects, viz. a Knight, a Chaplain, and a Servant at Arms, and those three joining the others choose a Master. This done, the three last shut themselves in a particular Chamber, whence they are called, after the President has done his Function. Then the Power of the eight ceases, and the three last approaching the President with Respect, take the Oaths before him, and choose a fourth; then afterwards a fifth, proceeding thus till they have chose eight, one of each Language: Afterwards they proceed again to the Election of eight others, so that there are two of each Language. These sixteen confess their Sins, take the Sacrament, and hear Mass; which done, they declare that they think themselves sufficiently enlightened, to raise a worthy and virtuous Subject to the Dignity of Grand Master, and take again the usual Oath before the whole Assembly: On which the Brothers swear likewise on their Cross, and the Habit of the Order, to acknowledge for their Grand Master, him that shall be elected by the sixteen, and to render him all Sort of Respect.

Afterwards the sixteen go to shut themselves in a Chamber, where they deliberate on the Subject of the Person they are to elect, and each judges with all the Freedom imaginable, of the Perfections and Imperfections, of the Virtues and Vices of those who are thought worthy of being elected. When they have made their Reflections, they throw anew wooden Balots into the Box, through the several Holes which are in it; and he who is found to have most Votes, is acknowledged for Grand Master. On this the sixteen rise, and go out of the Room they were shut in, and go to the President, and the whole Assembly, which wait their Return with Impatience. One of those who have made the Election asks, if all the Formalities have been well observ'd; and if the whole Order is of that Opinion, if they hold their Choice lawful; and if they will accept for Grand Master and Prince, him they have elected; to which the whole Nobility answers in the Affirmative. At the same Instant, one of those who have made the Election, proclaims aloud the Grand Master by his Name; and if he be present he is conducted with Respect to the Altar, where having been clothed with new Vestments, he takes the usual Oaths on the Book of the Laws and Institutes, in the Hands of the Prior of the Church of St. John. Afterwards all the Brothers go to compliment and kiss him. Then the Organ plays; and after the Ecclesiasticks have sung the *Te Deum*, the new Grand Master is conducted to his Palace; but if he be not present, a Deputy is sent to him immediately, to bring him to the Church of St. John, where being arrived, he is confirmed with all the Solemnities and Ceremonies above-mentioned; and if he was not in the Island, the Lieutenant continues to govern the Order till his Arrival.

The common Habit of the Grand Master, is a Cassock of Tapis, or Cloth, girt with a Girdle, to which is fastened a Purse, to signify Charity towards the Poor: And over that Cassock he wears a Kind of Velvet Gown, on the left Side whereof, and on the Shoulder, is the Cross of the Order, which he wears likewise on

his Breast. The Cloak heretofore already mentioned, called by the Order *Manteau a bec*, which is that given at the Profession, is black, and is fastened on the Neck by the String of the Order, which is of white and black Silk, where are represented the Mysteries of the Passion of our Lord *Jesus Christ*, interwoven with Baskets, which represent the Charity they exercise towards the Poor. This Mantle or Cloak has two Sleeves, very near a Yard long, wide of about half a Foot, terminating into a Point; which formerly were thrown over the Shoulders, and tied together on the Loins.

It appears by a Gold Coin of the Grand Master *Theodat de Gozon*, elected in 1346; and by the Seal of the Grand Master *Philibert de Naillac*, who succeeded *Fernandez Heredia* in the Year 1396; that antiently a *Capuche* was fasten'd to that Mantle.

The Habit of the great Crosses, when they are at Church, is a Kind of black Gown, called *Clocia* or *Bell*, open before, with large Sleeves, on the left Side thereof, on the Breast, and the Shoulder is the Cross of the Order, with the great String, and a Sword at their Side. When they go to the Council they have such a black Gown, but shut before, having only the great Cross on the Breast, without Sword or String.

The Brother's Chaplains, when they go out through the Town, are dressed like other Ecclesiasticks, having only on their Cassock and Cloak, on the left Side, the Cross of the Order. At Church they have a Linen Rochet, and over it a black Camail, where is the Cross of the Order. Pope *Clement XI.* at the Request of the Grand Master *Raymond de Perellos de Rocafort*, granted to sixty Chaplains of this Order, leave to wear a Violet Camail; but none but those who reside at *Malta*, make Use of that Privilege; some in *France*, wanting to wear that Violet Camail, the Archbishop of *Aix* was the first who opposed it.

Note, That next follows the *Chronological Succession* of all the Grand Masters of the Order of St. John of Jerusalem, or of Malta. The first Column contains the Number of Grand Masters; the second the Years of Christ; the third, their respective Names, &c. and the fourth, their Years of Masterhip.

CHRONOLOGICAL SUCCESSION of the GRAND MASTERS of the Order of St. John of Jerusalem, or Malta.

| | | | |
|----|------|--|----|
| | | GERARD, was Rector of the Hospital of St. John of Jerusalem, after the taking of the City in 1118. | |
| 1 | 1118 | Fr. RAYMOND DU PUY, a Frenchman, was the first who bore the Title of Grand Master. | 42 |
| 2 | 1160 | Fr. EUGENIUS DE BALBEN. | 3 |
| 3 | 1163 | Fr. ARNAUD DE COMP. | 4 |
| 4 | 1167 | Fr. GILBERT D'ASSALI. | 2 |
| 5 | 1169 | Fr. CASTE. | 1 |
| 6 | 1169 | Fr. JOBERT. | 10 |
| 7 | 1179 | Fr. ROGER DE MOULINS. | 8 |
| 8 | 1187 | Fr. GARNIER DE SORIA, a Neapolitan, who died the same Year. | 1 |
| 9 | 1187 | Fr. EMENGARD D'APS. | 5 |
| 10 | 1192 | Fr. GEOFFROY DE DUISON. | 2 |
| 11 | 1194 | Fr. <i>Alphonfus</i> of Portugal: He abdicated | 2 |
| 12 | 1196 | Fr. GEOFFROY LE ROY, a Frenchman | 10 |
| 13 | 1207 | Fr. GUERIN DE MONTAIGNE, ditto | 23 |
| 14 | 1230 | Fr. BERTRAND DE FOIX, ditto | 10 |
| 15 | 1240 | Fr. GERIN, a Frenchman | 4 |
| 16 | 1244 | Fr. BERTRAND DE CAMPS. | 4 |
| 17 | 1248 | Fr. PETER DE VILLEBRIDE, Frenchman | 3 |
| 18 | 1251 | Fr. WILLIAM DE CHATEAUNEUF, a Frenchman | 9 |
| 19 | 1260 | Fr. HUGUES REVEL. | 13 |
| 20 | 1278 | Fr. NICOLAS LORGUE, a Frenchman | 10 |
| 21 | 1288 | Fr. JOHN DE VILLIERS, a Frenchman, who died at Limisso, in the Island of Cyprus | |
| 22 | 1294 | Fr. ODO DE PINS, a Frenchman, elected in Cyprus, but died in his Way to Rome | 1 |
| 23 | 1298 | Fr. WILLIAM DE VILLARET, a Frenchman, elected at Limisso | 12 |

| | | |
|----|------|---|
| 24 | 1306 | Fr. FOULQUES DE VILLARET, a Frenchman, who conquered Rhodes, was deposed, and afterwards restored by Pope John XXII. after which he abdicated voluntarily. During his Deposition Fr. Maurice of Pagnac, a Frenchman likewise, was elected; but his Election having been declared null, he ought not be ranked among the Grand Masters. The former governed the Order. |
| 25 | 1312 | Fr. ELION DE VILLENEUVE, a Frenchman, elected by Pope John XXII. in Avignon, at the Nomination, and with the Suffrages of the Knights |
| 26 | 1346 | Fr. THEODORE DE GOZON, a Frenchman, elected at Rhodes, the first who bore the Title of Grand Master. |
| 27 | 1353 | Fr. PETER DE CORINGLAND, a Frenchman |
| 28 | 1355 | Fr. ROGER DE PUIS, a Frenchman |
| 29 | 1365 | Fr. RAYMOND BERENGER, Frenchman |
| 30 | | Fr. ROBERT DE JULIAC, a Frenchman |
| 31 | 1376 | Fr. JOHN FERNANDEZ D'EREDIA, Aragonese, died at Avignon |
| 32 | 1385 | Fr. RICHARD CARACCIOLI, a Neapolitan, elected at Valmont by Pope Urban VI. against Fernandez; but he was not acknowledg'd at Rhodes, and governed only in Italy |
| 33 | 1396 | Fr. PHILIBERT DE NAILLAC, a Frenchman |
| 34 | 1421 | Fr. ANTONY FLUVIANO, a Catalonian |
| 35 | 1437 | Fr. JOHN LASTIC, a Frenchman, called the Great, a Name which devolved afterwards to his Successors |
| 36 | 1454 | Fr. JAMES DE MILLY, a Frenchman, the first who bore the Title of Grand Master |
| 37 | 1461 | Fr. PETER RAYMOND JACOSTE, a Frenchman, who died at Rome |
| 38 | 1467 | Fr. BAPTIST URSINI, a Roman, elected at Rome; he died at Rhodes |
| 39 | 1476 | Fr. PETER D'AUBUSSON, a Frenchman, made Cardinal by Pope Innocent VIII. in 1488. |
| 40 | 1503 | Fr. AMERIC D'AMBOISE, a Frenchman |
| 41 | 1512 | Fr. GUY DE BLANCFORT, a Frenchman |
| 42 | 1513 | Fr. BABRICIUS DE CATETTO, Italian |
| 43 | 1521 | Fr. PHILIP DE VILLIERS DE LISLE ADAM, a Frenchman, under whom Rhodes was lost, and the Religion established in the Island of Malta, by a Concession from the Emperor Charles V. |
| 44 | 1534 | Fr. PERRIN DEL POUTE, an Italian, the first elected at Malta |
| 45 | 1535 | Fr. DIDIER DE SAINTE GALLE, a Frenchman, died at Montpellier |
| 46 | 1536 | Fr. JOHN OMEDES, an Arragonefe |
| 47 | 1553 | Fr. CLAUDIUS DE LA SANGLE, a Frenchman |
| 48 | 1557 | Fr. JOHN DE LA VALETTE, Frenchman |
| 49 | 1568 | Fr. PETER DEL MONTE, an Italian |
| 50 | 1572 | Fr. JOHN L'EVEQUE, a Frenchman; he was suspended of his Office, which was discharged by a Lieutenant; and restored afterwards by Pope Gregory XIII. |
| 51 | 1582 | Fr. HUGUES LOUBENS DE VERDALE, a Frenchman, made Cardinal by Pope Sixtus V. in 1587. |
| 52 | 1595 | Fr. MARTIN GARCIAS, an Arragonefe |
| 53 | 1601 | Fr. ALOPHE DE VIGNACOURT, a Frenchman |
| 54 | 1622 | Fr. LOUIS MENDEZ DE VASCONCELOS, a Portuguese |
| 55 | 1623 | Fr. ANTONY DE PAULE, a Frenchman |
| 56 | 1636 | Fr. JOHN PAUL LASCARIS DE CASTELLARE, a Frenchman |
| 57 | 1657 | Fr. MARTIN REDIN, Arragonefe, elected while he was Viceroy of Sicily |

| | | | |
|----|------|---|----|
| 58 | 1660 | Fr. ANET DE CLERMONT, OF DE GASSAN, a Frenchman | 1 |
| 59 | 1660 | Fr. RAPHAEL COTTONERO, a Spaniard | 3 |
| 60 | 1663 | Fr. NICOLAS COTTONERO, Raphael's Brother | 16 |
| 61 | 1680 | Fr. GREGORY CARAFFA, a Neapolitan | |
| 62 | . | . | |
| 63 | . | Fr. RAYMOND DE PERELLES DE ROCAFULT. | |
| 64 | . | . | |

Note, That there are also Ladies, Chevaliereffes of the Order of St. John of Jerusalem, or Malta, whose Institution is as follows.

When Godfrey de Bouillon entered Jerusalem in the Year 1099, Gerard, as already observed, was then Director of the Hospital of St. John Baptist, having afterwards changed that Hospital into a religious Order, he took the Habit thereof, and made three Vows of Religion; which Example was also followed by a Roman Lady called Agnes, who was then Abbess of the Hospital of St. Mary Magdalen, who together with her Nuns, made a solemn Profession of the same Rule established by Gerard, took the same Habit, and obliged themselves to observe the same Vows. This was the Origin of the Orders of Knighthood founded for Women; and the Establishment was made like that of the Knights, 1104, under Baudouin I. King of Jerusalem.

The Chevaliereffes of Agnes's Institution, were not contented with assisting the Poor who visited the holy Places, but lifted up their Hands likewise to Heaven, the better to contribute by their Prayers towards maintaining the Faith and Religion, while the Knights were fighting the Saracens. These Ladies had, like the Knights, for Mark of Distinction, a white Cross with eight Points.

There is a great Appearance that the Establishment subsisted in Palestine, till the Knights of St. John of Jerusalem were forced to abandon it, after the Infidels had rendered themselves Masters of the whole Country.

We do not know for Truth, if what remained of those illustrious Ladies, fled to Cyprus together with the Knights of their Order who escaped the Fury of the Barbarians, after the Ruin of St. John of Acre. What's certain is, that the Institution of those Ladies passed into Spain, when the Christian Princes, and the Knights of St. John of Jerusalem, were expelled from that City by the Saracens, and perhaps some Time before.

It was Queen Sancha, Daughter of Alphonse King of Castile, and Wife of Alphonse King of Arragon, called the Chaste, who founded at Sexena, in the Kingdom of Arragon, a Monastery of Ladies of St. John of Jerusalem, for the Reception of young Maids of Quality who had no Fortune. That House was richly endowed by her Liberalities. Therefore those are certainly mistaken who have made the Grand Master Raymond Berenger, Founder of that Monastery in 1365, but that Glory is due to another Raimond Berenger, styled the Provisor of the Brothers of St. John, and who lived in 1188, which is the Year that that House was founded.

After King Alphonfus's Death, Sancha's Husband, that Princess retired with her Daughter Dulcis, into that Monastery, where, together with some other Ladies of the Royal Blood, they took the Habit. Blanche, Daughter of James II. King of Arragon, has been superior in that Monastery, which is built in a spacious Place, and environed with Walls like a Citadel. The Princess has her Palace apart, richly furnished. The Ladies wear a white Cross, and the Prioress a great one on the Stomach. When she dies her Obsequies are celebrated during seven Days, and afterwards her Seal is broke.

The Ladies of Arragon and of Catalonia, who enter that House must be of so illustrious a Race, as to have no need to make Proofs of Nobility. The others make them in the Manner of the Knights. When they go to Church they wear a large Mantle, and a Sceptre of Silver in their Hand. The Prioress names to all the Benefices with Care of Souls, within her Territories, and gives the Habit of Obedience to all the Priests. She visits her Estates, with the Ladies her Assistants, and assists at the provincial Chapters of the Order in Arragon, where she has her Seat and Vote, like the Knights.

About

About the Year 1460 the Ladies Chevaliereffes of that Monastery, substracted themselves from the Obedience of the Grand Masters of the Order, and submitted immediately to the holy See. But *Hieronima d'Olino*, Prioreff of that House, sent to *Malta Alphonsus Studillo*, to negotiate the Reunion of that Monastery with the Order of *St. John of Jerusalem*, which was executed in 1569.

In 1212 another Monastery of *Chevaliereffes* of the same Order was founded, under the Name of *Nostra Signora d'Algaire*. It was built on a high Mountain of *Catalonia*, on the River *Ravacorga*. *Saurina de Jorba*, and *Etta de Segardia*, two *Catalan Ladies*, gave large Estates to that Monastery. To be received in it one must make Proofs of Nobility by the Attestation of several Witnesses; and by Presentation of Quarters.

About the Year 1370, five noble *Florentine Ladies* founded a Monastery of this Order, under the Name of *St. Joannin*. The Grand Master *Caracciolo*, or *John Fernandez de Eredia*, after he had founded that House at *Florence*, gave them the Hospital of *St. Nicolas*, with the Estates and Rights depending thereof. *Perette Andreativiani* was elected first Abbess, and *Commendatrice* of that House.

Isabella of Leon, who descended from one of the most illustrious Houses of *Andalusia*, resolved to establish at *Seville* a Convent of *Cordeliereffes* under the Rule, and with the Habit of *St. John of Jerusalem*, with Leave from the Grand Master *d'Aubusson*, which she obtained, and was called Prioreff of the Convent of which she was Founder.

Another *Isabella Fernandez* founded in *Portugal*, a Monastery of the same Order in the City of *Evora*. The Infant *Don Louis*, perpetual Administrator of the Priory of *Portugal* erected another House of the same *Chevaliereffes* at *Flor de Rosas*, in the City of *Estremos*.

There is also in the *Quercy*, a small Province of *France*, a celebrated Monastery of reformed Nuns of the Order of *St. John of Jerusalem*.

Those Ladies *Chevaliereffes* are cloathed in Black, have a white Cross with eight Points on the Breast, and another on the Left-Side of their Mantle; where they have likewise eight small different Rounds, where are represented the principal Mysteries of the Passion.

There is also another of these Monasteries at *Toulouse*.

The *TEMPLARS*, *TEMPLERS*, or *Knights of the Temple*, was a religious-military Order, first established at *Jerusalem*, in favour of the Pilgrims travelling to the holy Land. The Original of this Order is this: In 1118, some pious noble Persons devoted themselves to the Service of God, in the Presence of the Patriarch of *Jerusalem*; promising to live in perpetual Chastity, Obedience, and Poverty, after the Manner of Canons.

The two principal Persons were *Hugo de Paganis*, and *Geofroy of St. Omers*. *Baldwin II.* then King of *Jerusalem*, gave them an Apartment in his Palace, near the Temple of *Jerusalem*, not far from the Sepulchre of our Saviour; whence their Denomination *Templars*.

Soon afterwards the Canons of the Temple gave them a Piece of Ground hard by the said Temple, to build them regular Houses on; and the King, the Lords, the Patriarchs, and the Prelates, each gave them somewhat out of their Revenue for Food, and Cloaths.

Their first Undertaking, and what they had first in View, at their Institution, was to guard the Highways against Robbers, chiefly for the Safety of Pilgrims and Croisiers.

The principal Articles of their Rule, were: That they should hear the holy Office throughout every Day; or, that when their military Duties should prevent this, they would supply it by a certain Number of *Pater noster*: That they would abstain from Flesh four Days in the Week, and on *Fridays* from Eggs and Milk-meats: That each Knight might have three Horses, and one Equite; and that they should neither hunt, nor fowl.

Their first Rule was that of *St. Bernard*: Nine Years after their Foundation, a particular Rule was prescribed them in the Council of *Troyes*.

In every Nation they had a particular Governor, called *Master of the Temple*, or of the *Militia of the Temple*.—Their *Grand Master* had his Residence at *Paris*, still called of their Name, the *Temple*.

The Order of *Templars* was abolished at the Beginning of the 14th Century under *Clement V.* Pope, *Philip the Fair King of France*, and *Edward IV.* King of *England*.—In 1307, those in *England* were all arrested, and seven burnt alive. In 1312, the Order was quite suppressed in the Council of *Vienne*, in *Dauphiny*, and fifty burnt alive at *Paris*, their Grand Master included; who, while at the Stake, summoned the Pope, and the King of *France*, to God's Tribunal, who both died the same Year.

The Crimes they were charged withal, were apostatizing to the *Saracens*, and holding Correspondence with them: Of making nocturnal Assemblies, where they adored the Head of an Ass, &c. Some Authors will have it those Crimes were all pretended; and that the true Reason of the Suppression of the Order was the immense Riches they were possessed of. The Truth is, that a sordid Avarice reigned among them, which had made them commit very enormous Crimes, particularly of having refused to remit some Tributes to a *Saracen Prince*, called *Le Vieux de la Montagne*, who offered to turn Christian, with all his Subjects on that Condition. But though this might be some Reason for their Suppression, it could be none for burning them alive: Add to this, that their Effects were given to the Hospitalers, or Knights of *St. John*. What then did the Kings of *France* and of *England* get by their Suppression? and what was it to them which of those Orders had the Effects?—There is still remaining in the Chapel of the Temple, in *London*, a beautiful Monument of *Knights Templar*, which has escaped the Fury of the Rabble, during the late Civil Wars of *England*; and which the celebrated Society of the Temple preserve with great Care.

Note, That here follows an Abridgment of the Rules of the *Knights Templars*; of the *Ceremonies* used at their Reception, and the *Chronological Succession* of their Grand Masters.

C. I. *In what Manner they are to assist at the divine Service*.—You that have renounced the Pleasures of this World, &c. must be very devout to hear with a pure and devout Heart the Matins and the whole divine Service, according to the canonical Institution, and the Custom of the regular Doctors of the holy City, &c. and it behoves you in particular, after you have fed yourselves of the divine Aliment, and strengthened yourselves with the Precepts of the Lord, to have no Fear at the Approach of the Fight, but rather be ready to go and receive the everlasting Crown.

C. II. *If they cannot assist at divine Service, they must recite several Times the Lord's Prayer*.—But if any Brother for the Affairs of the Eastern Christian Church, finds himself at a greater Distance from Churches, we agree with an unanimous Consent, that in such a Case he shall say, for Matins, thirteen Times the Lord's Prayer, and seven Times for each Hour; but twelve Times for Vespers, &c.

C. III. *What must be done for every Brother deceased*.—When any Brother of the House shall pay the Tribute to Death, &c. we commonly call all the Chaplains, Clerks, Servants, &c. to offer, in the same Spirit of Charity, with a pure Heart, and in a solemn Manner, to *Jesus Christ*, the Sacrifice of the Mass for the Repose of his Soul; and the other Brothers shall be obliged to say a hundred Times the Lord's Prayer, till the seventh Day, &c. We desire besides, by a Motive of Charity and Mercy, and with a pastoral Authority command, that every Day, for forty Days successively, shall be given to some poor Person what was necessary for the Subsistence of the deceased Brother, as to Eating and Drinking, while alive. As for the other Charities which were given indiscretely to those who profess a voluntary Poverty to the Lord of the poor Knights of *Jesus Christ*, at the Death of the Brothers, at *Easter*, and other solemn Feasts, we forbid them absolutely.

C. IV. *The Chaplains must be contented with their Viuals, and the Vestment*.—With regard to all Sorts of Liberalities, and Sort of Alms, in what Manner soever they be administered, we order the Chaplains, and other Servant Brethren, to return them to the capitulary Commonalty; contenting themselves with their Viuals and

and Cloaths, without pretending any thing else, unless the Masters give it them with a free Will, and for Charity.

C. V. *Of the deceased Knights, who were only Knights for a Time.*—There are Knights in the House of God, and the Temple of Solomon, who stay with us, through God's Mercy, but for a certain Time; therefore we desire you, and strictly enjoin you, that when the Almighty has called some of them to himself, to give for God's Sake, and by the Motive of a paternal Piety, to some Poor, the Subsistence of seven Days, for the Soul of the Deceased.

C. VI. *That no private Brother of the House shall give Alms.* We have decreed, that no Brother of the House shall give Alms, but that Day and Night he shall remain in the Duty of his Profession; and shall conform himself to the wisest of all the Prophets: *I'll take the Chalice of Salvation, and I'll imitate in my Death, the Lord's Death, because as Christ has given his Life for me, I am ready to give up my Life for my Brethren.* That's the Oblation that is to be made; that's the living Host which is agreeable to God.

C. VII. *Not to remain too long standing.*—We have been informed by credible Witnesses, that while you assist at the divine Service, you stand too long, and without Rule, which Practice we condemn. Therefore after the Psalm, *Venite exultemus*, the Invitatory, and the Hymn, we command you, both strong and weak, to sit down, to avoid Scandal, rising only from your Seats, at the *Gloria Patri* of each Psalm, and bowing to the Altar, by a Motive of Respect for the Blessed Trinity; as well as at the Beginning of the Gospel, and at *Te Deum laudamus*; and you shall stand up during all the *Lauds*, the *Benedicamus Domino*, &c.

C. VIII. *Of the conventual Refection.*—We are persuaded that you take your Refection altogether in the same Place, or rather Refectory; therefore when you'll want something, and cannot be heard by Signs, you must go to fetch it gently. If at all Times you are obliged to fetch what you want with Meekness and Submission, how much more are you obliged to it at the Refectory, where the Apostle says, *You must eat your Bread in Silence.*

C. IX. *Of the Lecture, or reading at Table.*—A pious Lecture shall be made, while the Dinner and Supper last; for if we love the Lord, we must wish to hear with Attention his Word, and salutary Precepts.

C. X. *Of the Meal of Flesh.*—You must be satisfied to eat Flesh only three Times a Week, unless it be at *Christmas*, *Easter*, at the Feasts of the blessed Virgin, and *All Saints Day*. A too frequent Use of Flesh, serves only to fill the Body with an onerous Corruption: But if that Day of Fast, in which you are forbid Flesh, should happen on a *Tuesday*, the next Day following you shall have a sufficient Refection thereof. *Sunday*, it seems good and convenient, that there be given to all the Knights and Chaplains, two Dishes, because of Christ's Resurrection; but the Servants at Arms, and other Servants, must be contented with one Dish, with Thanksgiving.

C. XI. *In what Manner the Knights shall eat.*—The Knight shall eat two and two, &c. but each Knight shall have an equal Measure of Wine in his particular.

C. XII. *The other Days two or three Dishes of Legums must suffice.*—The other Days, viz. *Tuesday*, *Wednesday*, and *Saturday*, we are of Opinion that two or three Dishes of Legums, or other such Meats can suffice; therefore we order that no other shall be served, &c.

C. XIII. *What must be Friday's Viaticals.*—We have agreed, that for Frugality's Sake, from the Feast of *All Saints to Easter*, a single quadragesimal Meal shall suffice to all the Congregation, &c. except in case of Infirmary, or *Christmas*, or a Feast of the blessed Virgin, or of an Apostle, should happen on that Day, but at another Time, unless it be a general Fast, two Meals a-day are allowed.

C. XIV. *Of returning Thanks after their Meals.*

C. XV. *Of giving always the tenth Loaf to the Almoner.*—Though the Price of Poverty, which is the Kingdom of Heaven, be certainly due to the Poor, we command you notwithstanding, to give every Day to your Almoner the tenth of all the Loaves.

C. XVI. This Chapter regards only some Refreshment they were permitted to take, at the Discretion of the Superior, before they went to *Complies*, or Evening Prayers; and which consisted only in a Glass of Wine or Water, or Wine without Water, or Water alone.

C. XVII. *After Complies the Silence begins.*—After *Complies* the Knights must go to Bed. They are not to speak any more together, unless indispensably obliged to it. And if a Knight is to command something to his Servant at Arms, he must do it with a very low Voice; though in that Interval it is sometimes necessary to entertain the Master, or the Knight who under him has the Government of the House, and speak to him perhaps with other Brothers of some military Expedition, which must be done in few Words, &c.

C. XVIII. *Those who are fatigued, ought not to assist at Matins.*—We do not intend to oblige the Knights who are fatigued to rise in the Night for Matins, but on the contrary, they must take their Rest, which notwithstanding we leave to the Discretion of the Master, &c.

C. XIX. *An Equality must be observed between the Brethren in their Eating.*—The sacred Scripture teaches us, that there was an Allowance for every one, according to his Wants; therefore we do not say to have Regard to Persons, but to their Infirmary, &c.

C. XX. *Of the Quality and Fashion of the Vestment.*—We order that the Habits be always all of a Colour, either White or Black, and of a coarse Stuff; and we grant to all professed Knights to have two white Suits in Winter and Summer, if it can be done easily, &c. which Cloaths must be all of a Fashion, neither too long, nor too short, but suitable to the Shape of every one. When the Brethren have new Cloaths, they must immediately return their old ones, to be kept in the Wardrobe, or some other Place, for the Use of the Servants at Arms, or other Servants, and sometimes for the Poor.

C. XXI. In this Chapter the Servants are only forbidden to wear white Mantles.

C. XXII. This Chapter says, that none but the Knights of the House should wear white Cloaths.

C. XXIII. This forbids the Knights wearing any other Skins but those of Lamb or Ram.

C. XXIV. This orders that the old Cloaths shall be divided among the Servants at Arms.

C. XXV. *He that wants to have the best shall have the worst.*—If any Brother of the House, by a Spirit of Pride, claims a Right to what is finer and best, he shall deserve for his Presumption to have the worse.

C. XXVI. This regards the Quantity and Quality of the Vestments, which must be observed according to the Height and Bulk of the Knight.

C. XXVII. This treats of the same Subject.

C. XXVIII. *Of the Superfluity of the Hairs.*—All Brethren, especially those of the House, must have their Hair cut in such a Manner, that they may appear behind and before even and decent; observing inviolably the same Rule for the Beard and Mustachoes, that nothing appears superfluous and ridiculous.

C. XXIX. This Chapter relates to the same Thing.

C. XXX. *Of the Number of Horses and Servants at Arms.*—Each Knight is allowed to have three Horses, because the House of God, and of the Temple of Solomon cannot furnish more at present, and because of his Poverty, unless the Master orders it otherwise.

C. XXXI. *No Body shall strike a Servant at Arms that serves gratis.*—We do not allow more than a single Servant at Arms for each Knight. And if that Servant at Arms gives himself to the Knight *gratis*, and for Charity, he shall neither strike nor chastise him for any Fault whatever.

C. XXXII. *In what Manner are to be received those that are Knights for a Time only.*—We order to provide faithfully, for all the Knights who desire to serve for a Time in the same House, to *Jesus Christ*, Horses proper for that Service, Arms and all that is necessary, &c. And in the same Manner the said Knights shall be provided by the House, with a fraternal Charity, all he wants for himself, his Horses, and his Servant at Arms, with the Shoes for his Horses, &c. That if by some Accident the Knight should lose his Horses, the Master, according as the Faculties of the House shall allow it, must furnish him with others. But the Time of the Reparation happening,

About the Year 1460 the Ladies Chevaliereffes of that Monastery, substracted themselves from the Obedience of the Grand Masters of the Order, and submitted immediately to the holy See. But *Hieronima d'Olbingo*, Prioress of that House, sent to *Malta Alphonsus Studillo*, to negotiate the Reunion of that Monastery with the Order of *St. John of Jerusalem*, which was executed in 1569.

In 1212 another Monastery of *Chevaliereffes* of the same Order was founded, under the Name of *Nostra Signora d'Algaire*. It was built on a high Mountain of *Catalonia*, on the River *Ravacorga*. *Saurina de Jorba*, and *Etta de Segardia*, two *Catalan* Ladies, gave large Estates to that Monastery. To be received in it one must make Proofs of Nobility by the Attestation of several Witnesses; and by Presentation of Quarters.

About the Year 1370, five noble *Florentine* Ladies founded a Monastery of this Order, under the Name of *St. Joannin*. The Grand Master *Caracciolo*, or *John Fernandez de Eredia*, after he had founded that House at *Florence*, gave them the Hospital of *St. Nicolas*, with the Estates and Rights depending thereof. *Perette Andreativiani* was elected first Abbess, and *Commendatrice* of that House.

Isabella of Leon, who descended from one of the most illustrious Houses of *Andalousia*, resolved to establish at *Seville* a Convent of *Cordeliereffes* under the Rule, and with the Habit of *St. John of Jerusalem*, with Leave from the Grand Master *d'Aubusson*, which she obtained, and was called Prioress of the Convent of which she was Founder.

Another *Isabella Fernandez* founded in *Portugal*, a Monastery of the same Order in the City of *Evora*. The Infant *Don Louis*, perpetual Administrator of the Priory of *Portugal* erected another House of the same *Chevaliereffes* at *Flor de Rosas*, in the City of *Estremos*.

There is also in the *Quercy*, a small Province of *France*, a celebrated Monastery of reformed Nuns of the Order of *St. John of Jerusalem*.

Those Ladies *Chevaliereffes* are clothed in Black, have a white Cross with eight Points on the Breast, and another on the Left-Side of their Mantle; where they have likewise eight small different Rounds, where are represented the principal Mysteries of the Passion.

There is also another of these Monasteries at *Toulouse*.

The *TEMPLARS*, *TEMPLERS*, or *Knights of the Temple*, was a religious-military Order, first established at *Jerusalem*, in favour of the Pilgrims travelling to the holy Land. The Original of this Order is this: In 1118, some pious noble Persons devoted themselves to the Service of God, in the Presence of the Patriarch of *Jerusalem*; promising to live in perpetual Chastity, Obedience, and Poverty, after the Manner of Canons.

The two principal Persons were *Hugo de Paganis*, and *Geofroy of St. Omers*. *Baldwin II.* then King of *Jerusalem*, gave them an Apartment in his Palace, near the Temple of *Jerusalem*, not far from the Sepulchre of our Saviour; whence their Denomination *Templars*.

Soon afterwards the Canons of the Temple gave them a Piece of Ground hard by the said Temple, to build them regular Houses on; and the King, the Lords, the Patriarchs, and the Prelates, each gave them somewhat out of their Revenue for Food, and Cloaths.

Their first Undertaking, and what they had first in View, at their Institution, was to guard the Highways against Robbers, chiefly for the Safety of Pilgrims and Croises.

The principal Articles of their Rule, were: That they should hear the holy Office throughout every Day; or, that when their military Duties should prevent this, they would supply it by a certain Number of *Pater nosters*: That they would abstain from Flesh four Days in the Week, and on *Fridays* from Eggs and Milk-meats: That each Knight might have three Horses, and one Mule; and that they should neither hunt, nor fowl.

Their first Rule was that of *St. Bernard*: Nine Years after their Foundation, a particular Rule was prescribed them in the Council of *Troyes*.

In every Nation they had a particular Governor, called *Master of the Temple*, or of the *Militia of the Temple*.—Their *Grand Master* had his Residence at *Paris*, still called of their Name, the *Temple*.

The Order of *Templars* was abolished at the Beginning of the 14th Century under *Clement V.* Pope, *Philip the Fair* King of *France*, and *Edward IV.* King of *England*.—In 1307, those in *England* were all arrested, and seven burnt alive. In 1312, the Order was quite suppressed in the Council of *Vienne*, in *Dauphiny*, and fifty burnt alive at *Paris*, their Grand Master included; who, while at the Stake, summoned the Pope, and the King of *France*, to God's Tribunal, who both died the same Year.

The Crimes they were charged withal, were apostatizing to the *Saracens*, and holding Correspondence with them: Of making nocturnal Assemblies, where they adored the Head of an *Ass*, &c. Some Authors will have it those Crimes were all pretended; and that the true Reason of the Suppression of the Order was the immense Riches they were possessed of. The Truth is, that a sordid Avarice reigned among them, which had made them commit very enormous Crimes, particularly of having refused to remit some Tributes to a *Saracen* Prince, called *Le Vieux de la Montagne*, who offered to turn Christian, with all his Subjects on that Condition. But though this might be some Reason for their Suppression, it could be none for burning them alive: Add to this, that their Effects were given to the Hospitalers, or Knights of *St. John*. What then did the Kings of *France* and of *England* get by their Suppression? and what was it to them which of those Orders had the Effects?—There is still remaining in the Chapel of the Temple, in *London*, a beautiful Monument of *Knights Templar*, which has escaped the Fury of the Rabble, during the late Civil Wars of *England*; and which the celebrated Society of the Temple preserve with great Care.

Note, That here follows an Abridgment of the Rules of the *Knights Templars*; of the *Ceremonies* used at their Reception, and the *Chronological Succession* of their Grand Masters.

C. I. *In what Manner they are to assist at the divine Service*.—You that have renounced the Pleasures of this World, &c. must be very devout to hear with a pure and devout Heart the Matins and the whole divine Service, according to the canonical Institution, and the Custom of the regular Doctors of the holy City, &c. and it behoves you in particular, after you have fed yourselves of the divine Aliment, and strengthened yourselves with the Precepts of the Lord, to have no Fear at the Approach of the Fight, but rather be ready to go and receive the everlasting Crown.

C. II. *If they cannot assist at divine Service, they must recite several Times the Lord's Prayer*.—But if any Brother for the Affairs of the Eastern Christian Church, finds himself at a greater Distance from Churches, we agree with an unanimous Consent, that in such a Case he shall say, for Matins, thirteen Times the Lord's Prayer, and seven Times for each Hour; but twelve Times for Vespers, &c.

C. III. *What must be done for every Brother deceased*.—When any Brother of the House shall pay the Tribute to Death, &c. we commonly call all the Chaplains, Clerks, Servants, &c. to offer, in the same Spirit of Charity, with a pure Heart, and in a solemn Manner, to *Jesus Christ*, the Sacrifice of the Mass for the Repose of his Soul; and the other Brothers shall be obliged to say a hundred Times the Lord's Prayer, till the seventh Day, &c. We desire besides, by a Motive of Charity and Mercy, and with a pastoral Authority command, that every Day, for forty Days successively, shall be given to some poor Person what was necessary for the Subsistence of the deceased Brother, as to Eating and Drinking, while alive. As for the other Charities which were given indiscretely to those who profess a voluntary Poverty to the Lord of the poor Knights of *Jesus Christ*, at the Death of the Brothers, at *Easter*, and other solemn Feasts, we forbid them absolutely.

C. IV. *The Chaplains must be contented with their Vittuals, and the Vestment*.—With regard to all Sorts of Liberalities, and Sort of Alms, in what Manner soever they be administered, we order the Chaplains, and other Servant Brethren, to return them to the caputary Commonalty; contenting themselves with their Vittuals and

and Cloaths, without pretending any thing else, unless the Masters give it them with a free Will, and for Charity.

C. V. *Of the deceased Knights, who were only Knights for a Time.*—There are Knights in the House of God, and the Temple of Solomon, who stay with us, through God's Mercy, but for a certain Time; therefore we desire you, and strictly enjoin you, that when the Almighty has called some of them to himself, to give for God's Sake, and by the Motive of a paternal Piety, to some Poor, the Subsistence of seven Days, for the Soul of the Deceased.

C. VI. *That no private Brother of the House shall give Alms.* We have decreed, that no Brother of the House shall give Alms, but that Day and Night he shall remain in the Duty of his Profession; and shall conform himself to the wisest of all the Prophets: *I'll take the Chalice of Salvation, and I'll imitate in my Death, the Lord's Death, because as Christ has given his Life for me, I am ready to give up my Life for my Brethren.* That's the Oblation that is to be made; that's the living Host which is agreeable to God.

C. VII. *Not to remain too long standing.*—We have been informed by credible Witnesses, that while you assist at the divine Service, you stand too long, and without Rule, which Practice we condemn. Therefore after the Psalm, *Venite exultemus*, the Invitatory, and the Hymn, we command you, both strong and weak, to sit down, to avoid Scandal, rising only from your Seats, at the *Gloria Patri* of each Psalm, and bowing to the Altar, by a Motive of Respect for the Blessed Trinity; as well as at the Beginning of the Gospel, and at *Te Deum laudamus*; and you shall stand up during all the *Lauds*, the *Benedicamus Domino*, &c.

C. VIII. *Of the conventual Refection.*—We are persuaded that you take your Refection altogether in the same Place, or rather Refectory; therefore when you'll want something, and cannot be heard by Signs, you must go to fetch it gently. If at all Times you are obliged to fetch what you want with Meekness and Submission, how much more are you obliged to it at the Refectory, where the Apostle says, *You must eat your Bread in Silence.*

C. IX. *Of the Lecture, or reading at Table.*—A pious Lecture shall be made, while the Dinner and Supper last; for if we love the Lord, we must wish to hear with Attention his Word, and salutary Precepts.

C. X. *Of the Meal of Flesh.*—You must be satisfied to eat Flesh only three Times a Week, unless it be at *Christmas*, *Easter*, at the Feasts of the blessed Virgin, and *All Saints Day*. A too frequent Use of Flesh, serves only to fill the Body with an onerous Corruption: But if that Day of Fast, in which you are forbid Flesh, should happen on a *Tuesday*, the next Day following you shall have a sufficient Refection thereof. *Sunday*, it seems good and convenient, that there be given to all the Knights and Chaplains, two Dishes, because of Christ's Resurrection; but the Servants at Arms, and other Servants, must be contented with one Dish, with Thanksgiving.

C. XI. *In what Manner the Knights shall eat.*—The Knight shall eat two and two, &c. but each Knight shall have an equal Measure of Wine in his particular.

C. XII. *The other Days two or three Dishes of Legums must suffice.*—The other Days, viz. *Tuesday*, *Wednesday*, and *Saturday*, we are of Opinion that two or three Dishes of Legums, or other such Meats can suffice; therefore we order that no other shall be served, &c.

C. XIII. *What must be Friday's Viaticals.*—We have agreed, that for Frugality's Sake, from the Feast of *All Saints to Easter*, a single quadragesimal Meal shall suffice to all the Congregation, &c. except in case of Infirmary, or *Christmas*, or a Feast of the blessed Virgin, or of an Apostle, should happen on that Day, but at another Time, unless it be a general Fast, two Meals a-day are allowed.

C. XIV. *Of returning Thanks after their Meals.*

C. XV. *Of giving always the tenth Loaf to the Almoner.*—Though the Price of Poverty, which is the Kingdom of Heaven, be certainly due to the Poor, we command you notwithstanding, to give every Day to your Almoner the tenth of all the Loaves.

C. XVI. This Chapter regards only some Refreshment they were permitted to take, at the Discretion of the Superior, before they went to *Complies*, or Evening Prayers; and which consisted only in a Glass of Wine or Water, or Wine without Water, or Water alone.

C. XVII. *After Complies the Silence begins.*—After *Complies* the Knights must go to Bed. They are not to speak any more together, unless indispensably obliged to it. And if a Knight is to command something to his Servant at Arms, he must do it with a very low Voice; though in that Interval it is sometimes necessary to entertain the Master, or the Knight who under him has the Government of the House, and speak to him perhaps with other Brothers of some military Expedition, which must be done in few Words, &c.

C. XVIII. *Those who are fatigued, ought not to assist at Matins.*—We do not intend to oblige the Knights who are fatigued to rise in the Night for Matins, but on the contrary, they must take their Rest, which notwithstanding we leave to the Discretion of the Master, &c.

C. XIX. *An Equality must be observed between the Brethren in their Eating.*—The sacred Scripture teaches us, that there was an Allowance for every one, according to his Wants; therefore we do not say to have Regard to Persons, but to their Infirmary, &c.

C. XX. *Of the Quality and Fashion of the Vestment.*—We order that the Habits be always all of a Colour, either White or Black, and of a coarse Stuff; and we grant to all professed Knights to have two white Suits in Winter and Summer, if it can be done easily, &c. which Cloaths must be all of a Fashion, neither too long, nor too short, but suitable to the Shape of every one. When the Brethren have new Cloaths, they must immediately return their old ones, to be kept in the Wardrobe, or some other Place, for the Use of the Servants at Arms, or other Servants, and sometimes for the Poor.

C. XXI. In this Chapter the Servants are only forbidden to wear white Mantles.

C. XXII. This Chapter says, that none but the Knights of the House should wear white Cloaths.

C. XXIII. This forbids the Knights wearing any other Skins but those of Lamb or Ram.

C. XXIV. This orders that the old Cloaths shall be divided among the Servants at Arms.

C. XXV. *He that wants to have the best shall have the worst.*—If any Brother of the House, by a Spirit of Pride, claims a Right to what is finer and best, he shall deserve for his Presumption to have the worse.

C. XXVI. This regards the Quantity and Quality of the Vestments, which must be observed according to the Height and Bulk of the Knight.

C. XXVII. This treats of the same Subject.

C. XXVIII. *Of the Superfluity of the Hairs.*—All Brethren, especially those of the House, must have their Hair cut in such a Manner, that they may appear behind and before even and decent; observing inviolably the same Rule for the Beard and Mustachoes, that nothing appears superfluous and ridiculous.

C. XXIX. This Chapter relates to the same Thing.

C. XXX. *Of the Number of Horses and Servants at Arms.*—Each Knight is allowed to have three Horses, because the House of God, and of the Temple of Solomon cannot furnish more at present, and because of his Poverty, unless the Master orders it otherwise.

C. XXXI. *No Body shall strike a Servant at Arms that serves gratis.*—We do not allow more than a single Servant at Arms for each Knight. And if that Servant at Arms gives himself to the Knight *gratis*, and for Charity, he shall neither strike nor chastise him for any Fault whatever.

C. XXXII. *In what Manner are to be received those that are Knights for a Time only.*—We order to provide faithfully, for all the Knights who desire to serve for a Time in the same House, to *Jesus Christ*, Horses proper for that Service, Arms and all that is necessary, &c. And in the same Manner the said Knights shall be provided by the House, with a fraternal Charity, all he wants for himself, his Horses, and his Servant at Arms, with the Shoes for his Horses, &c. That if by some Accident the Knight should lose his Horses, the Master, according as the Faculties of the House shall allow it, must furnish him with others. But the Time of the Repartition happening,

happening, the Knight must give, for God's Sake, half the Price, and if he pleases accept the other from the Brethren in common.

C. XXXIII. *That no Body shall undertake a Journey without Leave.*—It becomes all Knights who have nothing more at Heart than to please *Jesus Christ*, to be obedient to the Master, &c. executing faithfully all that the Master, or the Person appointed by him, shall command, as if God himself was to command it, &c.

C. XXXIV. *The Knights are not allowed to go into the City without Leave of the Master.*—Therefore we desire such Knights who have renounced their own proper Will, as well as the other who serve for a Time, and command them not to go out of the House without the Master's Leave, unless it be in the Night to go to the Sepulchre, and other Stations which are within the City.

C. XXXV. *The Knights are not allowed to walk without a Companion.*—But those who walk thus are not allowed to set out, either in the Night or Day-time, without a Guard, *i. e.* without a Knight or a Brother; and when they are in the Fields, and have their Lodgment, no Knight, Squire, or Servant, ought to walk before the Lodgment of the other Knights, either to visit any of them, or speak with him, without Leave, &c.

C. XXXVI. *No Knight shall procure himself what he wants.*—Among other Things we command expressly the Observance of this Rule; and after having examined it, we order that it shall be observed, because of the Inconveniency of Begging. Therefore none of the Brethren is allowed to beg of his own Accord, or in his Name, either Horse, Equipage, or Arms, &c. But if it be known that his Infirmary, the Weakness of his Horse, and the Weight of his Horse be such, that he cannot travel without Prejudice, he shall come before the Master, or before whom it belongs to under the Master, and expose the Thing to him sincerely, and without Deceit, &c.

XXXVII. *Of the Bits and Spurs.*—We are not willing, that either Gold or Silver should appear on the Bits, Spurs, Bridles, &c. of the Horses of Knights, &c. neither are they to buy any. That if they be old Ornaments given for Charity, the Gold and Silver must be darkened so as not to appear with their usual Lustre. If they be lately given, the Master shall dispose of them as he thinks fit.

C. XXXVIII. *That the Launces and Bucklers be without Covering.*—The Launces, Bucklers, and Pikes, shall not be covered, because that renders them too cumbersome.

C. XXXIX. This Chapter says, that it belongs to the Master alone to give Horses, Arms, and other Things.

C. XL. This Chapter forbids the Knights having either Sack or Mail with a Lock to it, without the Master's Leave; from this Rule are excluded the Master, and the Procurators of Provinces.

XLI. *Of sending Letters.*—None of the Brethren is allowed to receive, or give Letters from their Parents, or from any body else, to one another, without the Master's or the Procurator's Leave. And when the Brother has obtained that Leave, the Master may have them read in his Presence if he pleases; and if his Parents send him something, he shall not accept it till he has declared it to the Master: The Master and Procurator are excepted from this Rule.

C. XLII. *Of mentioning one's Faults.*—We forbid every Brother living in the House, to entertain his Brother, or any body else with the Follies he has been guilty of, either in the World, or in his State of Knighthood; or with the Pleasures of the Flesh with common Prostitutes.

C. XLIII. *Of the Quest and Acceptation.*—When it shall happen that something is given *gratis* to a Brother, without his having asked for it, he must bring it to the Master, or to the Steward. But if his Friend or Relation will not give it but for his own proper Use, he shall not receive it without the Master's Leave; and he to whom it is given, must not be sorry if it be given to another, &c. From this Rule are excepted the Administrators, who have the Liberty of the Sack and Mail.

C. XLIV. This Chapter relates to the feeding of Horses.

C. XLV. This Chapter forbids exchanging and begging.

C. XLVI. *Of Hawking.*—We declare in common, that no body ought to take a Bird with another Bird, because it does not become the Religion to follow those worldly Pleasures and Diversions; but rather to hear the Precepts of the Lord, to confess every Day in our Prayers our Sins to God, with Sighs and Tears, &c.

C. XLVII. *Of not shooting with a Bow.*—We forbid expressly all professed Brothers taking the Liberty of shooting in Woods, or Hunting, or accompanying any body to the Chace, &c.

C. XLVIII. *Of shooting at the Lion.*—Since it is certain, that you are allowed in a particular Manner, and it belongs to you, to give your Soul for your Brethren, and to exterminate from the Earth all Infidels, Enemies of the Son of the Virgin; we have made this Commandment of the Lion, because it always seeks some body to devour, he is against all, and all are against him.

C. XLIX. *Of Judgments, &c.*—If any body in any Part of the East, where the Religion is established, or in any other Place, claims something against you, we command you to submit yourselves without Difficulty, to the Judgment of the Judges known for their Integrity, &c.

C. L. *To observe that Rule in all Things.*—We command you to observe that Rule for all Things which have been taken from you unjustly.

C. LI. *That it is permitted to all professed Knights to have Lands and Servants.*—As we have made a religious Knighthood, and as that Religion follows the Profession of Arms, and you can strike with them without Crime, we judge therefore, that being called Knights of the Temple, you can by reason of your rare Merit, and of the particular Gift of your Probity, have and possess Lands, Servants, and Husbandmen, and govern them with Justice, and that they are obliged to give you what is due to you, &c.

C. LII. *Of the Care of the Sick.*—Above all Things, a great Care must be taken of the sick Brethren, as if it was *Jesus Christ* himself; so that these Words of the Gospel, *I was infirm, and you visited me*, remain very well printed in the Memory. For they must be supported with Patience, and treated with Care, since it is certain, that thereby we acquire a heavenly Reward.

C. LIII. *The Sick must always have what's necessary.*—We command with all Sort of Consideration and Precaution, that the Procurators employed for the Infirmary, shall furnish them faithfully, and without Delay, all that is necessary for their Subsistence, in their several Maladies, according as the House can afford it, *viz.* Flesh, Fowls, and other Things, till they have entirely recovered their Health.

C. LIV. *That one shall not provoke another to Wrath.*

C. LV. *In what Manner married Brethren can be admitted.*—We permit you to have married Brethren, so that if they ask to be Partakers of your Fraternity, the Man and the Wife may make Donation at their Death of Part of their Revenue, and all they have acquired besides, provided notwithstanding they live honestly, and procure the Interest of the Brethren; but they shall not wear the white Habit: If the Husband dies first, he shall leave his Part to the Brethren, and the Wife shall subsist of the other. For we do not think it just that those Sorts of Brethren should live in the same House with those who have made Vows of Chastity.

C. LVI. *The Knights are not to have associated Sisters.* As it is dangerous to be associated with Sisters, because the ancient Enemy has put several out of the right Way to Salvation, by the Society of Women; therefore, dearly beloved Brethren, we forbid you to introduce that Custom.

C. LVII. This Chapter forbids the Brother Templars having any Communication with Excommunicates.

C. LVIII. *In what Manner secular military Men are to be received.* If any military Men out of the Mats of Perdition, or other secular, makes Choice of your Manner of Life, and your Society, he shall not be received immediately, but according to the Precept of St. Paul, *Try the Minds if they be of God*, and afterwards let him be admitted. The Rule shall be read in his Presence, and if he consents to the Precepts thereof, and it pleases the Master and Brethren to receive him, he must show his Desire, and make his Demand before the Assembly.

the Brethren. And afterwards the Master shall regulate the Conditions of his Probation, according to the Proofs he'll have of the good Life of the Candidate.

C. LIX. *All the Brethren shall not be called to the Privy Council.* We forbid calling always all the Brethren, but those whom the Master knows to be proper for it, and those capable of advising well; but when he shall want to treat of important Affairs, as of alienating some Land, or receiving a Brother, then it is proper, if he pleases, he should convoke the whole Congregation, and after he has heard the Advice of the whole Chapter, he shall do what he judges best, and most useful.

C. LX. In this Chapter it is commanded to pray in Silence.

C. LXI. *Of the Admission of Servants.* We have certain Knowledge, that several from different Provinces, as well Servants as Esquires, desire, for the Salvation of their Soul, to serve with Zeal in our House; therefore it is very well done to receive their Faith, that the Enemy should not suggest to them cunningly something bad in the Service of God, or hinder them from accomplishing their good Designs.

C. LXII. *Of not receiving young Children among the Templars.* Though the Rule of the holy Fathers allows to have Children in the Congregation; we do not approve of it; but he who intends to put his Son or Kinsman in the Religion of the Knights, and has made great Instances for it, must bring him up, till he has Strength and Courage enough to bear Arms to expel the Enemies of *Jesus Christ* from the holy Land. Afterwards, the Father or Parents must bring him, according to the Rule, in the Assembly of the Brethren, and there declare his Desire. *For it is much better not to devote oneself in Infancy, than to be guilty of a Recantation in a more advanced Age.*

C. LXIII. *Of the Honour due to Old Age.* The Old must be bore with, and honoured, through a Sentiment of Piety, and because of the Infirmary of their Age; and are not obliged to do the Duty of the Rule, &c.

C. LXIV. *Of the Brethren who are in the several Provinces.* The Brethren sent into several Provinces, must observe the Rule, as much as their Strength will allow it, as well in Eating and Drinking as in all other Things; and lead an irreproachable Life, &c. giving Examples of Wisdom, accompanied with good Works: Never lodging but in Houses of good Fame, and if it can be done there shall be Light that Night in the House of the Landlord, lest the tenebrous Enemy should procure some Occasion which we do not desire should happen, &c. We approve that the Brethren beyond the Seas should receive those who would make Instances for their Admission into the Order, on Condition that the Husband and the Wife shall come together before the Bishop of the Place, who shall hear the Request of the Postulant; and the Request heard, the Brother shall send the Husband to the Master and Brethren, who are in the Temple at *Jerusalem*; and if he be a good Liver, and worthy of such Society, he shall be received, if the Master and Brethren judge it proper. And if he happens to die afterwards, through much Fatigue and Labour, he shall be Partaker of all the Advantages of the poor Knights, as a Brother himself.

C. LXV. This Chapter regards the equal Distribution of Victuals.

C. LXVI. *Of the Templars being allowed to receive Tithes.* After you have quitted the Affluency of Riches, and have subjected yourselves to a voluntary Poverty, we think we are obliged to shew you how you can justly receive the Tithes to live in common. If the Bishop of the Church to which the Tithes are due of Right, will give them to you, with the Consent of his Chapter, they must be the Tithes which that Church possesses at that Time, &c.

C. LXVII. *Of slight and considerable Faults.* If a Brother, either in speaking, or fighting, or otherwise, has committed some slight Fault, himself must declare it to the Master, that he may receive a slight Penance for a slight Fault, and which is not too often repeated; but if he hides it, and it be known by some other, he must be subject to a more severe and more publick Correction; but if the Delict be great, he shall be sequestered from the Company of the Brethren, and from eating with them at the same Table, and must take his Refection

alone by himself, &c.

C. LXVIII. *For what Faults a Brother must be expelled.* —Previously to any Thing else, Expedients must be found that a Brother, powerful or not, strong or weak, and growing proud by Degrees, who undertakes to defend his Offence, shall not remain unpunished. If he will reform, a severe Correction will be sufficient; but if after salutary Advices, and Prayers made for him, he will not, but on the contrary grows more and more insupportable, then, according to the Apostle's Command, he must be separated from the Flock. *Expel the Wicked from among you.* But however, the Master must have the Staff and Rod in his Hand; the Staff to support the Infirmities of the Weak, and the Rod to punish the Vice of the Delinquent by a Zeal of Justice. Which he must do in concert with the Patriarch, and after much Reflection; lest according to St. *Maxime*, a too great Weakness, or a too great Severity, should hinder the Sinner from repenting of his Fault.

C. LXIX. *There will be allowed but one Linnen Shirt from Easter to All-Saints Day.* Having considered that some Regard should be had to the great Heats of the East, there shall be given, not of Right, but by Favour, a single Linnen Shirt to every one from *Easter* to *All-Saints Day*; and at other Times they shall wear Woollen Shirts.

C. LXX. *Of the Furniture of the Beds.* We all judge proper, that every one shall lay a-part in a Bed, unless it be in case of Necessity; each having a Couch or a Bed, at the Discretion of the Master; but we believe that a Sacking or Matrafs, and a Blanket are sufficient, &c. Linnen Sheets shall be allowed, and the Brothers shall lie in their Shirts and Drawers, having a Light in their Room while they are asleep.

C. LXXI. *Of Murmuring.* We command you to avoid, according to the divine Exhortation, *Envies, Jealousies, Confidences, Evil-speaking*, as a Sort of Plague. Let every one take great Care not to accuse his Brother in Secret, or reprimand him, remembering what the Apostle says, *Be not Reprehensors nor Murmurers among the People.* When you'll know manifestly that a Brother has sinned, reprimand him gently in private, according to the Command of our Lord; and if he does not mind you, call another Brother, and if he despises both, let him be reprimanded publickly in the Convent before all. Those are very blind that speak ill of the others, and it is a great Misfortune for those who cannot refrain their Tongue, which plunges them in the antient Malice of the cunning Enemy.

C. LXXII. *Of not kissing a Woman.* —We think it very dangerous to all Religion to mind too much the Face of Women; therefore none of the Brethren shall take the Liberty to kiss either a Widow, a Virgin, a Sister, an Aunt, a Friend, or any other Woman. The Knights of *Jesus Christ* must avoid the Kisses of Women, whereby Men commonly run very great Risks, that they may always walk with a pure Conscience, and without Fear in the Presence of the Lord.

Note, That the above-mentioned Rules were proposed by St. *Bernard*, Abbot of *Clairvaux*, and approved and confirmed by the Council of *Troyes* in *Champagne*, Nine Years after the Institution of the Order of the Templars.

In that same Council was regulated by the Pope's Order, the particular Form of their Habit, which was a white Mantle to cover their Arms; and *Stephen*, Patriarch of *Jerusalem*, affixed on the left Side of that Mantle a red patriarchal Cross. If we believe certain Authors, they were not allowed during the first nine Years of their Institution to be more than nine; but fifty Years afterwards their Number was so much increased, that they found themselves capable to undertake any Thing. Then they assembled at *Jerusalem*, and resolved, without the Participation of the Patriarch, to chuse a Chief, and accordingly by the Example of the Knights of St. *John*, they elected a *Fren lman* for Grand Master, and to succeed *Hughes* their Institutor; whereby there were instituted in the Order Knights great Croiles, Commanders, Knights, and Esquires.

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tion, taking the Name of *Hospitallers*, and that afterwards Part of them, at the Example of the other *Hospitallers*, followed the military Profession, and served with Honour and Courage the Christian Princes who conquer'd the *Holy Land*; without forgetting to practise Hospitality. This engaged the Kings of *Jerusalem*, *Baudouin II.*, *Foulques*, *Amaury III.* and *IV.* and the Queen *Melesinda* and *Theodore*, to take their Order under their Protection, and to give it very large Possessions. They received likewise several Privileges from the sovereign Pontiffs; and being passed into *Europe*, the Princes of this Part of the World gave them large Possessions. *Alexander IV.* put them under the Protection of the Holy See, in the Year 1257, and confirmed all the Donations, which the Emperor *Frederick II.* had made them in *Sicily*, in the *Pouille*, in *Calabria*, and in some other Provinces. *Henry* King of *England*, Duke of *Anjou*, and *Normandy*, *Thibaut* Earl of *Blois*, and several others, increased their Revenues. But of all the Christian Princes, there were none from whom the Knights of *St. Lazare* received greater Advantages, than from the Kings of *France*: For having been expelled from the *Holy Land* in 1253, they followed *St. Louis* into *France*, who, in Gratitude for the Services they had done him in the East, confirmed to them the Donations of the Kings his Predecessors, put them in Possession of several Houses, Commanderies, and Hospitals, which that Prince founded. It was then they established the Chief of their Order at *Boigny* near *Orleans*, which had been given them ever since the Year 1154, by *Louis VII.* called the *Younger*; and that the Grand Master took the Title of Grand Master of the Order of *St. Lazare*, as well this Side as beyond the Seas; his Jurisdiction extending not only on the Knights who were in *France*, but likewise on Foreigners. Therefore *John* of *Couras*, who had been promoted to that Post in 1342, by *Philip* of *Valois*, gave Power in 1354, to Brother *John Hallied*, a Scotchman, to govern in his Name, as well in the spiritual as the temporal, all that belonged to the Order in *England* and *Scotland*, on Condition, that he should remit every Year to the Grand Commandery of *Boigny*, 30 Marks Sterling of Silver. King *Charles V.* called the *Wise*, having given the Grand Mastership in 1477, to *James de Bernes*, that Grand Master gave to Brother *Dominick* of *St. Roy*, the Commandery of *Sringon* in *Hungary*, and constituted him his Vicar General in that Kingdom, on Condition to assist at the general Chapters at *Boigny*, and to bring along with him 40 Marks of fine Silver.

The Knights of *Lazare*, made antiently solemn Vows, and there were even Nuns of that Order, and there is yet a Monastery of them in *Switzerland*. It is pretended, that the Knights of *St. Lazare* did not begin to wear the Cross with eight Points, before the End of the fifteenth Century; or the Beginning of the sixteenth. The most antient Monument which can shew which was the Habit of those antient Knights, is found in the Commandery of *Gratemont*, where at the Foot of an Image of *St. Antony* in Relievo, placed on a Kind of Column, are seen five Knights of *St. Lazarus* kneeling, armed with Courasses, and a Chaplain of the same Order, having all a long black Mantle, on which is a simple Cross, a little adorned at the Extremities, but that which is on their Breast is different, in that it is a little longer at the Foot, and terminates into a Point.

For in fact, it was but towards the End of that Century, or at the Beginning of the following, after Pope *Leo X.* re-established the Order of *St. Lazarus* in *Italy*, that the Knights of that Order took the Cross with eight Points; for in the Privileges of the Order printed at *Rome*, in 1566, there is a Vignette, where are seen several Knights having all a long Beard, and receiving the Cross of the Order and a Sword from the Pope's Hand; and those Knights have a black Gown with large Sleeves, and a Cross with eight Points on the Breast. There is likewise in the King of *France's* Library, a Print of the Year 1525, which represents the different Orders, who follow the Rule of *St. Augustin*, where is seen a Knight of *St. Lazare*, with such a Gown.

VOL. II.

Note, That here follows a Chronological Succession of the Grand Masters of the Order of *St. Lazare*. The first Column contains the Years of Christ, the second, the Names of the Grand Masters, &c. and the third, the Years of their Mastership.

CHRONOLOGICAL SUCCESSION of the Grand Masters of the Order of *St. Lazare*.

| | | |
|------|--|----|
| 1490 | PETER D'AUBUSSON, Grand Mast. of <i>Rhodes</i> , and Grand Master of <i>St. Lazare</i> , by the Union made in 1490. He died in 1503. | 13 |
| 1503 | AIMERIC D'AMBAC, Grand Master of <i>Rhodes</i> , and of <i>St. Lazare</i> , died in 1512. | 9 |
| 1512 | GUY of BLANCFORT, Grand Master of <i>Rhodes</i> , and of <i>St. Lazare</i> , died in the Year following. | 1 |
| 1513 | FABRICIUS DE CARETTO, Grand Master of <i>Rhodes</i> , and of <i>St. Lazare</i> , died in 1521. | 8 |
| 1521 | PHILIP DE VILLIERS, Grand Master of <i>Rhodes</i> , afterwards of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1534. | 13 |
| 1534 | PERIN DE PONT, Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1535. | 1 |
| 1535 | DIDIER of <i>St. JALLE</i> , Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1536. | 1 |
| 1536 | JOHN DIOMEDE, Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1553. | 17 |
| 1553 | CLAUDIUS DE LA SANGLE, Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1557. | 4 |
| 1557 | JOHN DE LA VALETTE, Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , till the Separation made of those two Orders in 1565. | 8 |
| 1565 | JEANNOT DE CASTILLON, Grand Master of <i>St. Lazare</i> , elected by the Pope, till the Cession he made of that Dignity to the Dukes of <i>Savoy</i> . | 10 |
| 1575 | EMANUEL PHILIBERT, Duke of <i>Savoy</i> , died in 1580. | 5 |
| 1580 | CHARLES EMANUEL I. Duke of <i>Savoy</i> , died in 1630. | 50 |
| 1630 | VICTOR AMADÆUS I. Duke of <i>Savoy</i> , died in 1637. | 7 |
| 1637 | CHARLES EMANUEL II. Duke of <i>Savoy</i> , died in 1675. | 38 |
| 1675 | VICTOR AMADÆUS, Duke of <i>Savoy</i> , King of <i>Sardinia</i> , died in 1732. | 65 |
| 1732 | CHARLES EMANUEL III. King of <i>Sardinia</i> , one of the greatest Princes of this Age. | |

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The TEUTONICK Order, is a military religious Order of Knights, established towards the Close of the 12th Century; and thus called, because consisting principally of *Germans* or *Teutons*.

The Origin, &c. of this Order was thus:—The Christians under *Guy* of *Lusignan* laying Siege to *Acre*, or *Acon*, a City in *Syria*, on the Borders of the *Holy Land*; at which Siege were present, *Philip Augustus* King of *France*, *Richard* King of *England*, &c. Some *Germans* of *Bremen* and *Lubeck*, touch'd with Compassion for the Sick and Wounded of the Army, who wanted common Necessaries, set on foot a Kind of Hospital under a Tent, which they made of a Ship's Sail; and here betook themselves to a charitable Attendance on the Sick.

This started a Thought establishing a military Order, in Imitation of the *Templars* and *Hospitallers*.

The Design was approved by the Patriarch of *Jerusalem*, the Archbishops and Bishops of the neighbouring Places, the King of *Jerusalem*, the Masters of the Temple,

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In *France*, this Order was united to that of *N. D.* of *Mount Carmel*, in 1608; and had some new Advantages conferred on it by the late King *Louis XIV.* The Knights of *St. Lazarus* are allowed to marry, and yet have Pen- sions upon Benefices.

Note, That this Order is considered as more ancient than the two former above-mentioned, but as it was never so famous for their Feats of Arms, I only give it the third Place in this Account of the Military Orders. For some Authors pretend, that it owes its Origin to an Hospital built by *St. Basil*, in one of the Suburbs of *Cesarea*, in 370 or 371, and that the Zeal of *St. Basil* was imitated by several Cities, which, by his Example, built Hospitals, likewise, and that as the Leprous were very common at that Time, and could communicate their Malady by the single frequentation; the Hospitals assigned to them, were called *Maladeries*, under the Title of *St. Lazarus*; and that those who took Care of those Hospitals embraced the Rule of *St. Basil*; and formed an Institution different from his Order, under the Name of *St. Lazarus*, which was approved by Pope *Damasus*. What can be said for Truth, with Regard to the Knights of *St. Lazarus* is, that they began first by exercising Charity towards the poor Leprous, appointed for their Recep-

tion, taking the Name of *Hospitallers*, and that afterwards Part of them, at the Example of the other *Hospitallers*, followed the military Profession, and served with Honour and Courage the Christian Princes who conquer'd the *Holy Land*; without forgetting to practise Hospitality. This engaged the Kings of *Jerusalem*, *Baudouin II.*, *Foulques*, *Amaury III.* and *IV.* and the Queen *Melesinda* and *Theodore*, to take their Order under their Protection, and to give it very large Possessions. They received likewise several Privileges from the sovereign Pontiffs; and being passed into *Europe*, the Princes of this Part of the World gave them large Possessions. *Alexander IV.* put them under the Protection of the Holy See, in the Year 1257, and confirmed all the Donations, which the Emperor *Frederick II.* had made them in *Sicily*, in the *Pouille*, in *Calabria*, and in some other Provinces. *Henry King of England*, Duke of *Anjou*, and *Normandy*, *Thibaut Earl of Blois*, and several others, increased their Revenues. But of all the Christian Princes, there were none from whom the Knights of *St. Lazare* received greater Advantages, than from the Kings of *France*: For having been expelled from the *Holy Land* in 1253, they followed *St. Louis* into *France*, who, in Gratitude for the Services they had done him in the East, confirmed to them the Donations of the Kings his Predecessors, put them in Possession of several Houses, Commanderies, and Hospitals, which that Prince founded. It was then they established the Chief of their Order at *Boigny* near *Orleans*, which had been given them ever since the Year 1154, by *Louis VII.* called the *Younger*; and that the Grand Master took the Title of Grand Master of the Order of *St. Lazare*, as well this Side as beyond the Seas; his Jurisdiction extending not only on the Knights who were in *France*, but likewise on Foreigners. Therefore *John of Couras*, who had been promoted to that Post in 1342, by *Philip of Valois*, gave Power in 1354, to Brother *John Hallided*, a *Scotchman*, to govern in his Name, as well in the spiritual as the temporal, all that belonged to the Order in *England* and *Scotland*, on Condition, that he should remit every Year to the Grand Commandery of *Boigny*, 30 Marks Sterling of Silver. King *Charles V.* called the *Wise*, having given the Grand Mastership in 1477, to *James de Bernes*, that Grand Master gave to Brother *Dominick* of *St. Roy*, the Commandery of *Strington* in *Hungary*, and constituted him his Vicar General in that Kingdom, on Condition to assist at the general Chapters at *Boigny*, and to bring along with him 40 Marks of fine Silver.

The Knights of *Lazare*, made antiently solemn Vows, and there were even Nuns of that Order, and there is yet a Monastery of them in *Switzerland*. It is pretended, that the Knights of *St. Lazare* did not begin to wear the Cross with eight Points, before the End of the fifteenth Century; or the Beginning of the sixteenth. The most antient Monument which can shew which was the Habit of those antient Knights, is found in the Commandery of *Gratemont*, where at the Foot of an Image of *St. Antony* in Relievo, placed on a Kind of Column, are seen five Knights of *St. Lazarus* kneeling, armed with Cuirasses, and a Chaplain of the same Order, having all a long black Mantle, on which is a simple Cross, a little adorned at the Extremities, but that which is on their Breast is different, in that it is a little longer at the Foot, and terminates into a Point.

For in fact, it was but towards the End of that Century, or at the Beginning of the following, after Pope *Leo X.* re-established the Order of *St. Lazarus* in *Italy*, that the Knights of that Order took the Cross with eight Points; for in the Privileges of the Order printed at *Rome*, in 1566, there is a Vignette, where are seen several Knights having all a long Beard, and receiving the Cross of the Order and a Sword from the Pope's Hand; and those Knights have a black Gown with large Sleeves, and a Cross with eight Points on the Breast. There is likewise in the King of *France's* Library, a Print of the Year 1525, which represents the different Orders, who follow the Rule of *St. Augustin*, where is seen a Knight of *St. Lazare*, with such a Gown.

VOL. II.

Note, That here follows a *Chronological Succession* of the Grand Masters of the Order of *St. Lazare*. The first Column contains the Years of Christ, the second, the Names of the Grand Masters, &c. and the third, the Years of their Mastership.

CHRONOLOGICAL SUCCESSION of the Grand Masters of the Order of *St. Lazare*.

| | | |
|------|--|----|
| 1490 | PETER D'AUBUSSON, Grand Mast. of <i>Rhodes</i> , and Grand Master of <i>St. Lazare</i> , by the Union made in 1490. He died in 1503. | 13 |
| 1503 | AIMERIC D'AMBAC, Grand Master of <i>Rhodes</i> , and of <i>St. Lazare</i> , died in 1512. | 9 |
| 1512 | GUY of BLANCFORT, Grand Master of <i>Rhodes</i> , and of <i>St. Lazare</i> , died in the Year following. | 1 |
| 1513 | FABRICIUS DE CARETTO, Grand Master of <i>Rhodes</i> , and of <i>St. Lazare</i> , died in 1521. | 8 |
| 1521 | PHILIP DE VILLIERS, Grand Master of <i>Rhodes</i> , afterwards of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1534. | 13 |
| 1534 | PERIN DE PONT, Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1535. | 1 |
| 1535 | DIDIER of ST. JALLE, Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1536. | 1 |
| 1536 | JOHN DIOMEDE, Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1553. | 17 |
| 1553 | CLAUDIUS DE LA SANGLE, Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , died in 1557. | 4 |
| 1557 | JOHN DE LA VALETTE, Grand Master of <i>Malta</i> , and of <i>St. Lazare</i> , till the Separation made of those two Orders in 1565. | 8 |
| 1565 | JEANNOT DE CASTILLON, Grand Master of <i>St. Lazare</i> , elected by the Pope, till the Cession he made of that Dignity to the Dukes of <i>Savoy</i> . | 10 |
| 1575 | EMANUEL PHILIBERT, Duke of <i>Savoy</i> , died in 1580. | 5 |
| 1580 | CHARLES EMANUEL I. Duke of <i>Savoy</i> , died in 1630. | 50 |
| 1630 | VICTOR AMADÆUS I. Duke of <i>Savoy</i> , died in 1637. | 7 |
| 1637 | CHARLES EMANUEL II. Duke of <i>Savoy</i> , died in 1675. | 38 |
| 1675 | VICTOR AMADÆUS, Duke of <i>Savoy</i> , King of <i>Sardinia</i> , died in 1732. | 65 |
| 1732 | CHARLES EMANUEL III. King of <i>Sardinia</i> , one of the greatest Princes of this Age. | |

Note, That, by what I have said of the Succession of the Grand Masters of *St. Lazare*, in *France*, ever since Pope *Innocent VIII.* suppressed in *Italy*, in 1490. That Father *Bonani* is mistaken in his Catalogue of the *Military Orders*, when he says, that after the Suppression of that Order, its Memory was darken'd by Degrees in *France*; since it has always subsisted in that Kingdom, where it has lost nothing of its Splendor. I'll shew the Sequel of that Succession, when I speak of the Order of *Our Lady* of Mount *Carmel*.

The TEUTONICK Order, is a military religious Order of Knights, established towards the Close of the 12th Century; and thus called, because consisting principally of *Germans* or *Teutons*.

The Origin, &c. of this Order was thus:—The Christians under *Guy* of *Lusignan* laying Siege to *Acre*, or *Acon*, a City in *Syria*, on the Borders of the *Holy Land*; at which Siege were present, *Philip Augustus* King of *France*, *Richard* King of *England*, &c. Some *Germans* of *Bremen* and *Lubeck*, touch'd with Compassion for the Sick and Wounded of the Army, who wanted common Necessaries, set on foot a Kind of Hospital under a Tent, which they made of a Ship's Sail; and here betook themselves to a charitable Attendance on the Sick.

This started a Thought establishing a military Order, in Imitation of the *Templars* and *Hospitallers*.

The Design was approved by the Patriarch of *Jerusalem*, the Archbishops and Bishops of the neighbouring Places, the King of *Jerusalem*, the Masters of the Temple,

Temple, and of the Hospital, and the German Lords, and Prelates, then in the Holy Land, &c. and, by common Consent, *Frederick* Duke of *Suabia*, who was then at their Head, sent Embassadors to his Brother *Henry*, King of the *Romans*, to solicit the Pope to confirm the new Order.

Calistus III. who then governed the Church, granted it by a Bull of the 23d of *February*, 1192; and the new Order was called, *The Order of TEUTONICK Knights of the House of St. Mary of Jerusalem*.

The Pope granted them all the Privileges of the Templars, and the Hospitallers of *St. John*; excepting that they were to be Subjects to the Patriarchs, and other Prelates; and that they should pay Tithe of what they possessed.

The first Master of the Order *Henry Walpot*, elected during the Time of the Siege of *Acre*, after the Taking of that City, purchased a Garden, wherein he built a Church, and an Hospital, which was the first House of the *Teutonic Order*.—Such is the Account given by *Peter of Duisbourg*, a Priest of this Order.

Jacques de Vitry differs a little therefrom; and relates, that the *Teutonic Order* was established at *Jerusalem* before the City of *Acre* was besieged.

These two Opinions *Hartnoch*, in his Notes on *Duisbourg*, reconciles, by saying, that the Order was first instituted by a private Person, a German, at *Jerusalem*; that it was confirmed by the Pope, the Emperor, and the Princes, at the Siege of *Acre*; and that after the Taking that City it was become so considerable, that it was known all over the World.

If it be true, that it was a private Person who first set on foot the Order, and that those People of *Bremen* and *Lubeck* only joined with them, as some Authors assert, we do not know the precise Year of its Origin.

The Order made no great Progress under the three first Grand Masters; but under the fourth, *Herman de Salza*, it became very powerful; infomuch that *Conrad* Duke of *Mezavia* and *Cujavia*, about the Year 1230, sent an Embassy to him, to solicit his Friendship and Assistance, offering him and his Order the Provinces of *Culmes* and *Livonia*, with all the Lands they could recover from the idolatrous *Prussians*, who harrassed him exceedingly by their continual Incursions, and against whom he intended this new Militia; his own Knights of the Order of *Christ*, or of *Dobrin*, instituted for the like Purpose, being found too weak.

De Salza accepted the Donation; and *Gregory IX.* confirmed it; and to aid the Knights in reducing the *Prussians*, *Innocent IV.* published a Croisade.—With this Help, in a Year's Time, they subdued the Provinces of *Warmia*, *Nathomia*, and *Bartbia*; the Inhabitants whereof renounced the Worship of the Idols; and in the Course of fifty Years more, they reduced all *Prussia*, *Livonia*, *Samogitia*, *Pomerania*, &c.

In 1204, Duke *Albert* had founded the Order of *Sword-Bearers*, *Port-Glaives*, which now became united to the *Teutonic Knights*, and the Union was approved by Pope *Gregory IX.*

Haldemar III. King of *Denmark* sold to the Order the Province of *Lithuania*, the City of *Nerwa*, and *Wessenberg*, and some other Provinces.

A new Union, some Time afterwards, occasioned great Divisions and Troubles in the Order: It was with the Bishops and Canons of *Prussia* and *Livonia*, who hereupon took the Habit of the *Teutonic Order*, and shared the Sovereignty with the Knights, in their respective Dioceses.

The Order, thus Master of all *Prussia*, built the Cities of *Elbing*, *Marientburg*, *Thorn*, *Dantzick*, *Konigsberg*, and some others: The Emperor *Frederick II.* permitted to add to the Arms of the Order the Imperial Eagle; and *St. Louis*, in 1250, allowed them to quarter the *Flowers de Lis*.

After the City *Acre* had been recovered by the Infidels, the Grand Master of the *Teutonic Order* removed his Seat from that City to *Marientburg*.—As the Order grew in Power, the Knights took more State on them; and at length, instead of Friars, Brothers, as at first, would be called *Lords*. And though the Grand Master *Conrad Zolnera*, of *Rosinheim*, opposed this Innovation, his Successor *Conrad Wallerod* not only approved it, but

even procured himself to be treated with Honours only rendered to the greatest Princes.

Divisions being got into the Order, the Kings of *Poland* made their Advantage of them: The *Prussians* revolted to them; and after several Wars between the Knights and the *Poles*, the former yielded to King *Casimir* the upper *Prussia*, and did Homage to him for the lower.

Lastly, at the Time *Luther* did set all Germany in Flames, *Albert* Marquis of *Brandenbourg*, then Grand Master, turning *Lutheran*, renounced the Dignity of Grand Master, dissolved the Commanderies, and drove the Knights out of *Prussia*.

Most of the Knights followed his Example, and embraced *Lutheranism*: The rest of their Order transferred themselves to *Margentheim*, or *Marienthal*, in *Franconia*, where they still remain.

They there elected *Walter* of *Cranberg* their Grand Master, formed a Process against *Albert*, and the Emperor put him to the Ban of the Empire. The Order, however, could never recover their Domains; but are now little more than the Shadow of what they formerly were, having only three or four Commanderies, scarce sufficient for the ordinary Subsistence of the Grand Master and his Knights.

The Officers of the *Teutonic Order*, when in its Splendor, were the Grand Master, who resided at *Marientburg*; under him were the grand Commander; the grand Marshal, who had his Residence at *Konigsberg*; the grand Hospitaller, who resided at *Elbing*; the Draper, who took Care to furnish the Habits; the Treasurer, who lived at the Court of the Grand Master; and several Commanders, as those of *Thorn*, *Culme*, *Brandenbourg*, *Konigsberg*, *Elbing*, &c.

They had also their Commanders of particular Castles and Fortresses; Advocates, Proveditors, Intendants of Mills, Provisions, &c.

Waiffelinus in his Annals says, they had 28 Commanders of Cities, 46 of Castles, 81 Hospitallers, 35 Masters of Convents, 40 Stewards, 37 Proveditors, 95 Masters of Mills, 700 Brothers or Knights to take the Field, 162 Brothers of the Choir, or Priests, 6200 Servitors or Domesticks, &c.

Note, That here follows a concise Description of the antient Observances of the *Teutonic Order*, before Ambition was introduced into it.

1. To hinder the Knights from sinning against the Chastity they had vowed, their Rule forbids them all Sort of Conversation with Women, especially young ones; and a Knight was not even allowed to kiss his own Mother, in saluting her.

2. They professed so great a Poverty, that they could have nothing in Property without the Grand Master's, or the other Superior's Leave: Therefore they could have no Trunk, or Box, with a Lock to it, for fear they should be suspected of hiding Money, or locking up some other Thing forbidden by the Rule. What they possessed was only in the Name of the Order, or of the Chapter; and that only to distribute it to the Poor, or to the Sick, or to those of the Order who wanted it.

3. Some Authors say, that their first Grand Master order'd them to recite every Day, and every Night, a hundred Times the Lord's Prayer, the Symbol of the Apostles, and the *Ave Maria*; but the Rule did not order so great a Number.

4. Their Cells were always to be left open, that nothing should be hid from the Sight of the Superior, who was commonly a Commander.

5. There were twelve Knights in every Convent, in Honour of the twelve Apostles, and *Winnick* of *Kuniprade*, nineteenth Grand Master, order'd, that besides the twelve Knights, there should be six Chaplains. There were about forty of those Sorts of Convents; and sometimes several of them in the same Place.

6. Their Bed was only Straw in a Sack of coarse Cloth.

7. Their Arms were neither to be gilt nor silver'd.

8. The Age appointed by the Rule, for the Admission into the Order was fifteen; and the Subjects were to be strong and robust to bear the Fatigue of the War.

9. The

9. This *Order* was divided like that of *Malta*, into three Classes, *viz.* of *Knights*, *Chaplains*, and *Servant-Brothers*. There were also married Men, who were permitted, as in the *Order* of *Malta*, to wear half Crosses. And I found that there were besides Nuns of that *Order*.

10. The Dignities of the *Order* were, as already mentioned, a *Grand Commander*, a *Grand Marshal*, a *Grand Hospitaller*, a *Draper*, and a *Treasurer*, who had every one their particular Employment. — The *Grand Commander*, presided at all the Councils, and governed the Province in the *Grand Master's* Absence: He had the Inspection on the Treasure, on the Corn, and on the Navigation; and the Brethren's Chaplains, and Servants at Arms, who lived in the first Convent, were to obey him. — The *Grand Marshal's* Office was to provide all that was necessary for the War; therefore all the Knights were to obey him in the *Grand Master's* Absence; he furnish them their Arms and Horses, which notwithstanding he was not allowed to buy without the *Grand Master's* Leave. Without the same Leave, he could not dismiss any Knight from the Army, or attempt to fight. In Time of Peace the *Grand Commander* had the Precedency of him; but in Time of War he preceded the *Grand Commander*. The *Grand Hospitaller* had the Care of the Poor, and of all the Hospitals, and commanded the inferior Hospitallers. He was not obliged to account for the Expences he made, and when he wanted Money, or other Things necessary for the Hospitals and the Poor, the *Grand Commander* was to supply him with them. — The *Draper* had the Care of the Habits of the Brethren. If a Piece of Cloth was given to a Knight, he could not keep it without the *Draper's* Leave. If the Piece of Cloth given was enough for two Mantles, he kept half of it for himself, and gave the other half to the *Draper*; who was also to furnish the Knights who were sent from one Convent to another, with what was necessary for their Journey; and the *Treasurer*, to be always ready to distribute what was necessary, lived always at the *Grand Master's* Court; to whom the great Officers were obliged to give every Month, their Accounts of the Expences they had, except the *Grand Hospitaller*.

Note, That the Election of the *Grand Master* was made during that flourishing State of the *Order* in the following Manner.

The *GRAND MASTER*, on his Death-bed, could give to what Knight he pleased, the Ring and Seal of his Dignity, to deliver it to his Successor. He that was intrusted with that *Depositum*, was declared Vicegerent, and govern'd the *Order* till the Election; but if that Knight was not agreeable to the whole Chapter, another was chosen after the *Grand Master's* Death.

That Vicegerent informed of that Death the provincial Masters, and fixed a Day for the Election, that those provincial Masters, with one or two Knights who were to be elected, might be present.

During that Time, all the Cloaths of the Deceased *Grand Master* were distributed to the Poor, one of whom was fed during a whole Year, which was also practised during forty Days, at the Death of every Knight.

The Day of the Election happening, the Mass was celebrated, after which, the Statutes of the *Order* were read, the Brethren recited fifteen Times the Lord's Prayer, and afterwards thirteen Poor were fed. The Vicegerent, with the Consent of the Assembly, elected a Knight to be Commander of the Electors. That Commander used to take another Knight for his Collegue; those two a third; and those three a fourth, and always increasing to the Number of thirteen. Among those Electors, there were a Chaplain, eight Knights, and four Brothers Servants, all of different Provinces.

After the Election, the Vicegerent conducted to the Altar, the new *Grand Master*; to whom after he had represented the Obligations, or Duties of his Employment, he deliver'd the Ring and Seal, which he had received from the late *Grand Master*, and kissed him.

Note, That here follows the Ceremonies which are still observed at the Installation of a *Grand Master* of the *Teutonic Order*, according to *Henry Low*.

He that has been elected for that Dignity, is conducted by all the Knights present, to the great Chapel;

where being arrived, he seats himself in a Chair, before which is a Pulpit, cover'd with black Silk, and placed at five Paces Distance from the great Altar. Then all the Bells are rung, and the Priest who officiates with the Deacon, sets the *Te Deum*, which is continued by the Choir, and followed by the Litanies, accompanied with Instruments; which ended, the Priest, before he begins Mass, addresses to the new elected, the following Words:

Most excellent Prince, this Day you are to receive the Marks of the *Grand Mastership* of the illustrious *Teutonic Order*, and intrusted with the Government thereof, it is proper we should humbly give you some Advices on that Employment, &c.

The Discourse ended, the Priest reads several Prayers, at the End whereof, he gives the Cross of *Prussia* to the *Grand Master*; then reads other Prayers, which concluded, the Keys and the Seal are deliver'd to him; and after several other Prayers, the Mass of the Holy Cross begins, which ended, the Musick sings the *Benedictus Dominus Deus Israel*.

Besides the Vows of defending the Church, these Knights are obliged to make that of Chastity.

The antient Habit of the *Grand Master*, was a long black Cloak of woollen Cloth, reaching down to the Feet, which *Augustin Maximilian Merhofen* believes to have been rather a Mantle of Parade, than the Habit of the *Order*.

The antient Habit of the Knights consisted of a white short Doublet, with a black Cross on the Breast charged with another Cross Argent. But on the left Side of their Cloak they had a black Cross with eight Points.

At present they wear over their common Cloaths, a white Mantle, on which, on the left Side, is a black Cross, orled Argent. The Cloak of the Knights reaches no farther than the Middle of the Leg.

Note, That next follows a *Chronological Succession* of the *Grand Masters* of the *Teutonic Order*, according to the Abbot *Giustiniani*. The first Column contains the Number of *Grand Masters*; the second the Years of Christ; the third, their respective Names, &c. and the fourth, their Years of *Mastership*.

CHRONOLOGICAL SUCCESSION of the GRAND MASTERS of the TEUTONICK ORDER.

| | | | |
|----|------|---|----|
| 1 | 1190 | HENRY of WALPOT, first Grand Master of the Hospital, and Order of St. Mary of Jerusalem, on Mount Sion, built by King Baudouin. | 10 |
| 2 | 1200 | OTHO of CARPEN of Bremen, | 6 |
| 3 | 1206 | HENRY, or according to others, HERMAN DE BRAT, of Alsace, died at Ptolemaide. | 4 |
| 4 | 1210 | HERMAN DE SALTZA, of GALTA, according to some Moderns, who undertook the Conquest of Prussia. | |
| | | Some put for fifth Grand Master, Henry of Hohenloe; but as the Chasseur does not mention him in the History of that Order, printed in 1680, we'll leave him out likewise. | |
| 5 | 1240 | CONRAD, Landgrave of Thuringia, established Grand Master by the Emperor Frederick II. died at Marburg in Hesse. | 12 |
| 6 | 1252 | POPPE D'OSTERN, or D'OSTERLING, whom his great Age obliged to abdicate. | 11 |
| 7 | 1263 | HANNON, or JOHN ANGERHAUSEN, of SANGERHAUSEN, of ZANGERHAUSEN. | 12 |
| 8 | 1275 | HERMAN, or HOTMAN HELDRUNGEN, died at Venice, where he resided. | 8 |
| 9 | 1283 | BURCHARD of SCHUNDEN. | 7 |
| 10 | 1290 | CONRAD FUCHTWANGEN, who established his Residence at Prague. | 7 |

| | | |
|----|------|---|
| 11 | 1297 | GODEFROI, or GEOFFROI, Count of <i>Hohenloe</i> , built <i>Marienburg</i> in <i>Prussia</i> , and abdicated in 1302. |
| 12 | 1303 | SIGEFROI of <i>Feuchtwangen</i> , transported the Seat of the Grand Masters to <i>Marpurg</i> in <i>Hesse</i> , then to <i>Marienburg</i> in <i>Prussia</i> . |
| 13 | 1312 | CONRAD, or, according to others, CHARLES BEFFAT or BEFFUT, of <i>Treves</i> . |
| 14 | 1325 | WERNERE, or WARENARE D'ORSELIM, or ARSEL, or according to others WERSELEN, killed by a Knight. |
| 15 | 1331 | LUDERE, Duke of <i>Brunswick</i> , conquered a great Part of <i>Great Poland</i> on the <i>Cossacks</i> . |
| 16 | 1335 | DIETERIC, Count of <i>Oldenbourg</i> , or according to others THEODORICK of <i>Altembourg</i> . |
| 17 | 1342 | LUDOLFE KOENIG, or CONING, of <i>Weirau</i> . |
| 18 | 1345 | HENRY DUSMER, or DUSNER, of <i>Alseberg</i> . |
| 19 | 1351 | WINRIC, or VERNRIC, of <i>Keciprode</i> or <i>Canippenrode</i> . |
| 20 | 1382 | CONRAD ZOLNER, of <i>Rodenstain</i> . |
| 21 | 1391 | CONRAD of <i>Valenrode</i> , or <i>Valrode</i> . |
| 22 | 1395 | CONRAD of <i>Jemgingen</i> , or <i>Lamgingen</i> . |
| 23 | 1407 | ULRIC of <i>Jemgingen</i> , Conrad's Brother, killed in a Battle against <i>Jagellon</i> King of <i>Poland</i> . |
| 24 | 1410 | HENRY of <i>Plowen</i> , or <i>Plotten</i> , deposed. |
| 25 | 1413 | MICHAEL CHUCHENMUSYER, of <i>Stemberg</i> , deposed likewise. |
| 26 | 1422 | PAUL BELLIZARE, or BELNITZER, or as others write it, BELLIGERE of <i>Rusdorff</i> . |
| 27 | 1441 | CONRAD D' <i>Erlichshausen</i> . |
| 28 | 1450 | LOUIS, Son of <i>Conrad d'Erlichshausen</i> , under whom Part of <i>Prussia</i> passed under the Obedience of the Crown of <i>Poland</i> . |
| 29 | 1467 | HENRY of <i>Plawen</i> , or <i>Plavender</i> . |
| 30 | 1470 | HENRY RESFLE of <i>Richtenberg</i> . |
| 31 | 1477 | MARTIN TRUSCHES of <i>Weshausen</i> , or according to others TRACHESE of <i>Wershausen</i> . |
| 32 | 1489 | JOHN of <i>Tieffen</i> , otherwise <i>Diepen</i> , confederate with the King of <i>Poland</i> . |
| 33 | 1498 | FREDERICK Duke of <i>Saxony</i> , Landgrave of <i>Thuringia</i> , and Marquis of <i>Misnia</i> . |
| 34 | 1511 | ALBERT, Marquis of <i>Brandebourg</i> , who embraced <i>Lutheranism</i> , and render'd himself Master of <i>Prussia</i> . |
| 35 | 1527 | WALTERN of <i>Cromberg</i> , who established the Seat of the Grand Master at <i>Mergentheim</i> in <i>Germany</i> , where it has continued ever since. |
| 36 | 1543 | WOLFGANG SCURBAR, or SCUTSPER, called <i>Mischiling</i> . |
| 37 | 1566 | GEORGE HUNDT of <i>Wenkbein</i> . |
| 38 | 1572 | HENRY OBENHAUSEN, or BOBENHAUSEN, renounced the Administration in 1585, and the Grand Mastership in 1590. |
| 39 | 1585 | MAXIMILIAN, Archduke of <i>Austria</i> . |
| 40 | 1618 | CHARLES, Archduke of <i>Austria</i> . |
| 41 | 1625 | JOHN EUSTACHIUS, of <i>Westernac</i> . |
| 42 | 1627 | JOHN GASPARD, of <i>Stadion</i> . |
| 43 | 1642 | LEOPOLD WILLIAM, Archduke of <i>Austria</i> . |
| 44 | 1662 | CHARLES JOSEPH, Archduke of <i>Austria</i> , elected by three Bailiffs or Directors of the Order. |
| 45 | 1664 | JOHN GASPARD, of <i>Ampringen</i> , the last of that House. |
| 46 | 1684 | LOUIS ANTONY, Prince of <i>Neubourg</i> , Son of the Duke and Elector Count <i>Palatine</i> of the <i>Rhine</i> . |

The Order of CALATRAVA, was instituted in 1158, by *Sancho III.* King of *Castile*, on the following Occasion: The *Moors* going to attack the City *Calatrava*, and the Templers who held it, surrendering it up to the King, on a Suspicion of their Inability to defend it, *Diego Velasquez*, a *Cistercian* Monk, but a Man of Quality, persuaded *Raymond* Abbot of *Fitero*, a Monastery of *Cistercians*, to beg *Calatrava* of the King. He obtained it, and *Raymond* and *Diego* put themselves in it; being followed by a great Number of People, who joined them out of Zeal for the Defence of *Calatrava*. The *Moors* abandoning the Enterprize, many of those who came to the Defence of the City entered the Order of the *Cistercians*; and that under a Habit more fit for military, than monastick Exercises. Accordingly they began to make Incursions on the *Moors*; which was the Rise of the Order of *Calatrava*.

The first Grand Master was *Garcias*; under whose Government the Order was confirmed by *Alexander III.* in 1164. In 1489, *Ferdinand* and *Isabella*, with the Consent of Pope *Innocent VIII.* reunited the Grand Mastership of *Calatrava* to the *Spanish* Crown; so that the Kings of *Spain* are now perpetual Administrators thereof: Though the General of the *Cistercian* Monks, and of the *Bernardins*, stile themselves general Superiors of *Calatrava*.

Note, That here follows an Abridgment of the antient Rule of the Order of *Calatrava*, of the antient Ceremonies used in the Reception of the Grand Master, Knights, &c. and a chronological Succession of the Grand Masters: Together with the Institution of the Nuns, or *Chevalieresses* of that Order.

As the *Knights* of *Calatrava*, at the Beginning of their Institution, lived in part as Ecclesiasticks, and in part as Laicks; they were always obliged to assist at the divine Service; and in time of War, used to take Arms against the *Moors*.—The Archbishop of *Toledo*, on account of the Victory of *Las Novas*, they gained in 1212, speaks of them thus: 'At the same Time 'they are employed in praising God by Canticks, and 'offer him their Sighs and Tears; they likewise take 'the Sword in Defence of their Country. Their Food 'is very simple, and their Habit a coarse woollen Stuff. 'They exercise themselves by a continual Discipline, 'and Silence accompanies all their Actions.

In fact, the Historians of that Order say, that they were obliged to wear none but woollen Shirts; that their Tunicks were to be made in such a Manner, as not to hinder them from mounting a Horse; that their Cloaks should be lined with Lamb-skins; and that the Scapulary was the Habit of the Order.—They were to lie in their Cloaths, have nothing superfluous in them, and which as to the Quality and Colour of the Stuff, were to be the same as those of the Religious of the same Order. They were to observe Silence in the Oratory, in the Refectory, and in the Kitchen. They might eat Flesh three Times a Week.

The Religious of *Cistaux* could not admit a Knight to Profession, without the Grand Master's Leave; and when they went into some Abbeys of *Cistaux*, they were not received in the Apartment of Strangers, but in the Inside of the Monastery like the Religious themselves, and were to live like the Lay Brothers of that Order: But the Pope gave them Leave afterwards to receive Chaplains, to administer the Sacraments to them.

After the Abbot *Raymond's* Death, the Knights of *Calatrava*, though most of them were but Lay Brothers of *Cistaux*, whom he had made take Arms, would have no more Monks among them, nor be governed by an Abbot: Therefore they elected for their first Grand Master *Don Garcias*, one of them.

Authors do not agree among themselves with Regard to the antient Form of the Habit of the Knights of *Calatrava*. Some of them pretend, that it was the same with that of the Monks of *Cistaux*; others say, that it was not different from that of the Secular; but they all agree that it had a white Scapulary with a black Capuche, fasten'd to a Kind of Camail, which they wore till the Year 1397. That the Anti-Pope *Benedict XIII.* whom they acknowledged in *Spain* for legitimate Pontiff, gave them Leave to leave off the Scapulary

ulary, and the Capuche, and order'd them to wear only on their Habit a Flower-de-lis'd Crofs of red Cloth, faſten'd on the left Side. Pope *Paul III.* permitted them afterwards to marry once.

At preſent, the Habit of Ceremony of the Knights of *Calatrava*, is a large white Mantle, on which there is, on the left Side, a red Crofs Flower-de-lis'd. Ever ſince the Year 1540, that the Knights were permitted to marry, they make but the Vows of Poverty and Obedience, and of a conjugal Chaſtity; and ever ſince the Year 1652, they have added a fourth, *viz.* of defending the immaculate Conception of the bleſſed Virgin *Mary*. They have for their Arms a Crofs of the Order, which is Gules in a Field Argent, with two Shackles Sable at the Foot of the Crofs.

Note, That here follows a *Chronological Succeſſion* of the *Grand Maſters* of the Order of *Calatrava*. The firſt Column contains the Number of Grand Maſters; the ſecond the Years of Chriſt; the third their reſpective Names, &c. and the fourth their Years of Maſterſhip.

ACHRONOLOGICAL SUCCESSION of the Grand Maſters of the Order of CALATRAVA.

| | | | |
|----|------|--|----|
| 1 | 1164 | DON GARCIA of NAVARRE, who obtained of the King the Dignity of Grand Maſter, and at the King's Sollicitation, the Confirmation thereof of Pope <i>Alexander III.</i> | |
| 2 | 2169 | D. FERDINAN ESCAZA, of the Frontier of <i>Navarre</i> . | 10 |
| 3 | 1179 | D. MARTIN PEREZ of SEJONES of <i>Tarrazone</i> in <i>Arragon</i> . | 3 |
| 4 | 1182 | D. NUGNO PEREZ of <i>Quignonez</i> , and of <i>Leon</i> . | 16 |
| 5 | 1198 | D. MARTIN MARTINEZ. | 8 |
| 6 | 1206 | D. RUIZ or RODERICK, of the Country of <i>Yanguas</i> . | 6 |
| 7 | 1212 | D. RODERICK GARCES, or GARCIA. | 3 |
| 8 | 1216 | D. MARTIN FERNANDEZ DE QUINTANA. | 2 |
| 9 | 1218 | D. GONZALEZ YANNEZ, or <i>John</i> . | 20 |
| 10 | 1238 | D. MARTIN RUIZ, or RODRIGUEZ. | 2 |
| 11 | 1240 | D. GANEZ MANRIQUE. | 3 |
| 12 | 1243 | FERDINAND ORDONNEZ, or ORDOGNEZ. | 11 |
| 13 | 1254 | D. PETER JANNEZ, or JOANNES. | 13 |
| 14 | 1267 | JOHN GONZALEZ. | 17 |
| 15 | 1284 | D. RUIZ or RODERICK PEREZ PONTE. | 11 |
| 16 | 1295 | D. DIEGO LOPEZ, of <i>St. Solez</i> of <i>Toledo</i> . | 1 |
| 17 | 1296 | D. GARCIA LOPEZ of <i>Padiglia</i> . D. GUTIERRE PEREZ. } intruded and D. ALEMANO } depoſed. | 35 |
| 18 | 1329 | D. JOHN NUGNEZ of <i>Prado</i> . | 26 |
| 19 | 1355 | D. DIEGO GARCIA of <i>Padiglia</i> . | 10 |
| 20 | 1365 | MARTIN LOPEZ of <i>Cordua</i> . | 4 |
| 21 | 1369 | D. PETER NUGNES of <i>Godoy</i> . | 15 |
| 22 | 1384 | D. PETER ALVAREZ PEREIRA, a <i>Portugueſe</i> . | 1 |
| 23 | 1385 | D. GONZALEZ NAGNEZ of <i>Guzman</i> . | 19 |
| 24 | 1404 | D. HENRY DE VIGLIENA. | 10 |
| 25 | 1414 | D. LOUIS GONZALEZ of <i>Guzman</i> . | 29 |
| 26 | 1443 | D. FERDINAND of <i>Padiglia</i> . | 1M |
| 27 | 1443 | D. ALPHONSE of <i>Arragon</i> , Son of the Infant Don <i>John</i> King of <i>Navarre</i> . | 14 |
| 28 | 1445 | D. PETER GIRON, elected againſt D. <i>Alphonſe</i> . | 20 |
| 29 | 1466 | RODERIC TELLEZ GIRON his Son. | 16 |
| 30 | 1482 | D. GARCIA LOPEZ of <i>Padiglia</i> . <i>There was no Grand Maſter during two Years.</i> | 5 |
| 31 | 1489 | D. FERDINAND V. and DONNA ZABELLA, King and Queen, and Adminiſtrators, by a Bull of the Pope. | 27 |
| 32 | 1516 | D. CHARLES of <i>Auſtria</i> , Prince of <i>Spain</i> , afterwards King and Emperor, and perpetual Adminiſtrator, by a Bull of the Pope. | 40 |

| | | | |
|----|------|--|----|
| 33 | 1556 | D. PHILIP II. King of <i>Spain</i> , by the Renunciation of his Father, perpetual Adminiſtrator. | 42 |
| 34 | 1598 | D. PHILIP III. King and perpetual Adminiſtrator. | 23 |
| 35 | 1621 | D. PHILIP IV. King and perpetual Adminiſtrator. | 46 |
| 36 | 1667 | D. CHARLES II. King and perpetual Adminiſtrator. | 34 |
| 37 | 1700 | D. PHILIP V. the preſent King of <i>Spain</i> . | |

Note, That the Grand Maſter *Gonzalez Yannez*, or *Ibaguez*, founded Nuns Chevaliereſſes of *Calatrava*, in 1219. They were firſt eſtabliſhed in a Convent of *St. Felix* near *Amaga*, in a Place called *Barrios*, where they remained about 350 Years, till *Philip II.* King of *Spain*, and Adminiſtrator of that Order, transferred them into the City of *Burgos*, in the Year 1538. Some devout Maidens who wore the Habit of *Citiaux*, and lived in Communality, under the Jurisdiction of the Biſhop of *Siguença*, in the Convent of *St. Saviour* of *Pinilla*, ſubmitted themſelves, likewise, to the Order of *Calatrava*, about the Year 1479, under the Government of the Grand Maſter *Peter Giron*, who gave them ſome Inheritances belonging to the Order, and formed the ſecond Monastery of the Order of *Calatrava*. But the moſt illuſtrious was that founded by *Gautier* of *Padilla*, Grand Commander of the Order, at *Almagro*, under the Title of the *Aſſumption* of Our Lady, while King *Ferdinand* had the Adminiſtration of the Order. Thoſe Nuns have the Title of *Commandreſſes*; they wear a white Gown and Scapulary, with the Badge of the Knights of *Calatrava* on their Breſt, *viz.* a red Crofs with four Lillies at the four Corners, and Shackles, called in *Spaniſh* *Trowas*: Thoſe Ladies wear a noble Kerchief under their black Veil, granted them by Pope *Benedict*.

Note alſo, That I'll give in this Place a concise Account of the *Military Orders*, or accounted ſuch, which are ſuppoſed to have preceded thoſe heretofore mention'd; as the *Orders* of the *Golden Angel*, of the *St. Sepulchre*, of the *Croiſade*, &c.

The Order of the *Golden Angel*, or of *St. George*, is ſuppoſed to have been inſtituted by *Constantine the Great*, and which he compoſed of *Chriſtian* Soldiers, at the Neck of whom he faſten'd for a Reward of their great Actions, and for Mark of their Dignity, the Name of Chriſt, deſign'd by a Cypher, formed of an X and a P; with the Approbation of Pope *Silveſter*, who confirmed in an authentick Manner this new Inſtitution, as it appears by an antient Marble, which I have ſeen at *Rome*, where *Constantine* is repreſented ſitting on his Imperial Throne, giving the Crofs to the Knights, with this *Latin* Inſcription.

CONSTANTINUS MAXIMUS IMPERATOR,
POSTQUAM MUNDATUS A LEPRO
PER MEDIUM
BAPTISMATIS, MILITES SIVE EQUITES
DEAURATOS CREAT IN TUTELAM
CHRISTIANI NOMINIS.

i. e. the Emperor *Constantine the Great*, after he was cured of the Leproſy by Means of Baptiſm, created gilt Soldiers or Knights for the Defence of the Chriſtian Name.

The Knights of this Order had a Right to carry the Standards in the Armies, and were called *Præpoſiti Laborum*, or *Labarorum*, i. e. Chiefs of the military Works, or of the ſacred Standards; and alſo *Torquati*; becauſe of the Collar they wore. The great Number of Medals coined for them, the Statues erected to them, and the Inſcriptions made in their Honour, witneſs enough how much they were eſteemed by the Emperors. They were called *Knights of the Angel*, becauſe of the Angel who appear'd to *Constantine*. The *Golden Knights*, becauſe of their Collar which was Gold. And *Knights of Conſtantine*, becauſe inſtituted by that Emperor. The Cyphers of their Collar were compoſed of the Name of Chriſt, deſigned by the *Greek* Letters X and P, with the Letters

A and Ω, which signify, *Jesus Christus principium & finis*, i. e. Jesus Christ is the Beginning and the End.

The signal Advantages which the Christian Church obtained afterwards, having soon made her take another Form; this *Order* acquired, likewise, in Time, a much greater Lustre; for their Power, and great Riches, put them in a Condition to form a great Society, in which were established ecclesiastical and secular Offices, particularly those of *Grand Master*, of *Knights*, and of *Esquires*.

The *Grand Master* divided the whole *Order* into three Classes, with Regard to their Administration, or Functions. Some of them were called *Torquati*, because of their Collars. The second were *Knights of the Law*, and of what regards the ecclesiastical Functions. The last, was of the *Esquires*, or of those who served to carry the Shield. They were all obliged to obey the *Grand Master*, who in his Turn was to watch over their Conduct, and make them observe their Vows, and other Duties.

The Habit of Ceremony which the *Grand Master* wears at present, when he comes to the general Assembly, composed of fifty Counsellors, are, 1. For the Head, a Cap, *Macedonian* Fashion, of Crimson Velvet, lined inside with white Sattin, and on the Borders, which are divided into four Corners, garnished with Gold Threads interwoven together, and forming Cyphers, which contain the Name of *Christ*, composed of the two *Greek* Letters, X and P; over it is a Crown of Lillies and Fleurons, and a Feather of an *Indian* Bird. The Mantle is lined with Silver Cloth, and the Outside, which is of blue Velvet, is garnished at the Neck with a Crimson String, at both Ends of the String are two rich Buttons; and a large Knot, through which passes two other Strings, which fall negligently on the Back, and reach down as far as the Heels: This is called the Tail.

The Cross of the *Order* is of Crimson Velvet, orled Gold; and terminates into Flowers-de-lis, and has at the four Angles these Letters, I. H. S. V. *In hoc signo vinces, In this Sign thou shalt conquer.* The Letters X and P are in the Middle, interwoven together, and A and Ω make the Ornament of the left Side of the Mantle. The Collar is a Mixture of the same Cyphers several Times interwoven together, to which is fasten'd the great Cross of the *Order*, environ'd with Oak and Laurel Leaves; and underneath the Patron of the *Order*, viz. *St. George* fighting the Dragon. On the Cassock, which is of Silver Tissue is also the Cross embroider'd which covers the Breast.

The Virgin *Mary* holding the Infant *Jesus* in her Arms, is painted in their Banners of Procession, and in their Standards of War; and underneath a small Pendant, on which are read these same Words, *In hoc signo vinces.* On the other Side of the Banner are seen the Arms of the *Grand Master*.

The *Esquires* which compose the third Branch of the *Order*, have no other Marks of Distinction, but a blue Scarf, embroider'd with a Cross with three Points.

The *Senators* of this *Order*, who are fifty in Number, wear all a Cap like that of the *Grand Master*, the Crown, and the Bird's Feather excepted; instead whereof they have each another Kind of Feather. The Fashion of their Habit is like that above described, but the Stuff is different; for the Outside of the Cloak is of blue Armoisin, with a Lining of white Taffetas, and is fastened with a double red String hanging down to the Ground. This Mantle is adorned on the left Shoulder with a red Silk Cross embroider'd, and environ'd with Gold. The Collar is Gold, like that of the *Grand Master*, but smaller, and of a less Price. The Waistcoat and Girdle are of blue Silk, the military Coat and Busskins are of white Silk; the Shoes of the same Colour, fasten'd with Silk Strings, or Silver Buckles; and under the Cloak is a Sword fastened to a Belt, the Belt fastened over the Waistcoat.

The third Class of the *Knights of the Golden Angel*, includes those called *common Knights of Justice* or *Policy*, or of the *Law*, called also *given* or *gracious*, because, in their Reception, less Regard is had to their Birth, than to their Manners and Probity: Notwithstanding which, they arrive by Degrees to all the Honours and Employments of the *Order*. They are clothed in a Manner very

different from the other Knights: Their Cap blue, lined with white Armoisin, without a Crown, and only adorned with the Feather of an Ostrich. Their Mantle is like that above-mention'd, but they have neither Collar nor Cross on their Coat; in lieu thereof they wear on the Breast a Gold Cross fastened to a Chain of the same Metal, and on the left Shoulder of the Cloak a silk Cross embroider'd. Their Waistcoat is of white Silk, and all the rest of their Dress, is like that of the Knights great Crosses.

The *Ecclesiasticks*, or *Priests* of the *Order*, wear in the solemn Functions the common Cap of Priests, unless they be of the Number of Senators; for then their Cap is of blue Silk adorned, on the fore Part with a Cypher of the Name of Christ embroider'd Gold. Their Cloak is like that of the common Knights above-mention'd. But those who are not Senators, but only simple Chaplains, wear in the Function of their Ministry a long Cassock of blue Silk, and semblable, for the Form, to that which the other Ecclesiasticks commonly wear. They have over it, a Surplice of Cambrick, reaching to their Knees, with wide Sleeves, garnished as well as the Body of the Surplice, with a fine Lace. On the left Sleeve of the Surplice is embroidered with Silk the Cross of the *Order*. At other Times they wear a Gold Cross hanging at their Neck, and another fastened on their Cloak, &c.

The last Class of the *Order* of the *Golden Angel*, is that of the *Servant Knights*, who are of two Sorts, viz. the first who carry the Shield and Arms of the other Knights, and fight at their Side, to assist them on all Occasions; and the second are employed in the most servile Offices of the *Order*: They are inferior to others, and wear neither Sword nor Spurs, nor the rest of the military Ornaments the first are honoured with; they are, notwithstanding reputed Members of the *Order*, and though they wear also the Cross, they are not ranked among the Knights.

The principal Ornaments of the *Servant Knights* is a Sort of blue Silk Scarf, to which is fasten'd the Cross of the *Order* on the Breast, but without any Ornament, and without the Cypher, which compose the Cross of the other Knights. Moreover they wear a common Hat, and change nothing in the common Form of their Cloaths. In the Field they wear a short Waistcoat, on which is fastened the Cross of the *Order*. They use a Buckler, a Cuirass, and besides the Sword they wear at their Side, they are armed with a Pike. When they quit their Arms, they are obliged to wear always a Cross of Silk, embroider'd on their Cloak; and another of Gold hanging down on their Breast.

Among the most famous Heroes, who have signalized themselves in this *Order*, are reckoned several Saints, and a great Number of Princes and Lords. The Saints are *St. Demetrius*, *St. Procaius*, *St. Hippolitus*, *St. Mercurius*, *St. Martin*, *St. Theodorus*, *St. Vitalis*, and others, who have generously sacrificed their Life for the Defence of the Faith.

Among the Princes are, *Frederick* Emperor of the West, and *Henry* his Son; *Philip* King of France, *Richard* King of England, *William* King of Sicily, *Balthazar* King of Hungary, *Casimir* King of Poland, *Alphonfus* King of Arragon, *Don Alphonfus* King of Castile, *Don Emanuel* his Son: Among the Lords, *Otho* Duke of Burgundy; *Tancred* Guiscard, *Thomas* Earl of the *Allobroges*, *Obisson* Marquis of *Este*, *Heraclius* *Caucasene*, *Michael* *Sebasto*, *John* *Frederick* *Gonzague*, *Albert* Earl of *Habsbourg*, *Don Philip* Earl of *Flanders*, *Lazarus* *Herskovius*, the Earl *Michel* *Complaste*, *Don Guido* *Turiane*, Governor of *Ravenna*. And *Charles V.* Emperor, as well as his Son *Don Juan* of *Austria*.

The Privileges this *Order* enjoys, were granted to it by Pope *Leo I.* in 456, by the Emperor *Leo*, in 486, by *Isaac* *Ange* *Flavius* *Comnene*, in 1191, and by his Son, the Restorer of the *Order*; by *Michel* *Paleologue*, in 1293, and 1294; by Pope *Paul III.* in 1540; by *Calixt III.* *Pius III.* *Sixtus IV.* *Innocent VIII.* and *Jules III.* in 1545, and by a great Number of other Popes, Emperors, Kings, and other Sovereigns.

Note, That the Ceremonies used at the Reception of the *Knights of the Golden Angel*, having something very particular,

particular, and very august, I'll give here a concise Detail thereof, as follows.

At the Day appointed for that Solemnity, whether there be one or several Knights to be made, Care is taken to adorn magnificently the Church where it is to be celebrated; and a Scaffold is erected in it.

The Grand Master ought to be present at the Ceremony, accompanied with two Members of the Order, or at least with all those who can be there; who all come dressed in their Habits of Ceremony, with their Arms, and the Banners of the Order, each taking his Place according to his Rank.

The Grand Master seats himself in the Middle, having at his Right the Bishop or Priest, who is to make the Consecration, and at his Left, he that is entrusted with the Proofs, Letters, and Deeds, to receive and confirm the new Knight. In the Presence of all the Assembly come two or several Pages who bring in several Silver Basons the Habits of Ceremony of the new Knight, a Sword, a Girdle, and Gold Spurs, with Tapers, and go to place themselves at the Place appointed for them. They are followed by two Knights in long Cloaks, who have been chosen for Proxies, for the Knight who is to be consecrated, and is between them, and without any Arms, dressed in a white Waistcoat. In entering they all three go to salute the Master Altar, afterwards the Grand Master, the Prelate, and the Procurator, or him who is charged with the Pieces, and thence go to take their Place. The Tapers are lighted, and one of them is put in the right Hand of the new Knight. Afterwards the Hymn *Veni Creator* is sung, and the new Knight takes the Communion.

The Mass ended, the Pages rise and present the Basons with the Vestments, the Sword, and the Spurs to the Prelate or Priest, who blesses them with a Form of Prayers made for that Purpose.

The Benediction ended, the two Proxies rise, and go to place themselves at the Feet of the Prelate and Grand Master, to whom one of them shews, with much Respect, the Impatience of the Gentleman whom they present to be consecrated, and admitted into the Order. Afterwards the Knight, intrusted with the Proofs and Deeds, and sits on the Left of the Grand Master, assures him of their Validity, &c. Then one of the Assistants declares with a loud Voice, that no Body can enter the Order, unless he declares in formal Terms that he believes all that the Church believes; that he respects all that she respects and embraces all the Truths she teaches. On which the Candidate advances towards the Priest, who holds in his Hands the Book of the Gospel open, and repeats the Terms of that Confession, such as they are, contained in the Bull of Pope *Pius IV.* which are as follow.

I. N. believe and profess all, and every one of the Articles of the Faith professed by the holy *Roman Church*; viz. I believe in one God, the Father Almighty, Creator of Heaven and Earth, &c.

I receive and embrace the Apostolical and Ecclesiastical Traditions, and the other Observances and Constitutions of the same Church; as likewise the sacred Scripture, in the Sense of our holy Mother the Church, &c.

The Confession of Faith ended, the two Knights Proxy take, in the Silver Basons, the Habits of Knighthood, on which are pronounced some Prayers.

After this Benediction, the same two Knights, who are always present, help the new Knight to dress himself in the Habit of Ceremony; and the Grand Master gives him the Imposition of Hands; during which the Priest recites some Prayers.

This done, the Cross and the Collar of the Order, to which it is fastened, is presented to the Priest, in a Bason held by one of the Pages kneeling; and having blessed both, he takes the Cross and kisses it, and puts it into the Hands of the Grand Master; who having kissed it likewise, hangs it on the Neck of the Knight. This done, the other Page brings likewise, in a Silver Bason, the Belt and the Sword; which having been blessed by the Priest, one of the Knights Assistants takes the Sword and draws it, and Kneeling presents it to the Grand Master, while the Priest continues the Prayers.

Then the Grand Master gives the Sword back to one

of the Proxies, who in taking it kisses the Hand of the Grand Master, and puts it back into the Scabbard. At the same Time the Knight rises, and the two Proxies girt him with the Sword, while the Choir sing some *Responses*.—Which ended, the Knight steps a few Paces backward, strikes three Times in the Air with his naked Sword, leans three Times towards the Earth, and lastly kneels down.—The Grand Master approaches then, and drawing his own Sword, strikes him three Times gently on the Shoulder, saying these Words: 'Be a pacifick and courageous Warrior, and submitted to God.' And the Priest touching gently his Cheek, says; 'Awake from the Sleep of Malice, and watch in the Faith of Christ, and in a laudable Fame.'

Then the Gold Spurs being presented to the Grand Master, he takes them, and gives them to the Proxies, who has them fasten'd, by two Servants to the Heels of the Knight, while the Choir sing some Prayers.

The Office finished, the Knight comes forwards, and kneels at the Feet of the Grand Master, who embraces him: Then he rises, and goes to salute all the Knights of the Order who are present. But if he designs to make his Vows all at once, he goes to kneel at the Feet of the Priest; where he is asked by the Grand Master, if he has a firm Resolution and Intention to observe all the Statutes of the Order in general, and each of the Chiefs they contain in particular? To which he answers, Yes. Then two Choristers having brought the Missal with the Statutes of the Order to the Knees of the Priest, who having presented them to the Knight, he takes the Oaths, and makes his Vows.

The Vows made, the Knight kisses the Canon of the Mass, and the Grand Master adorns him with the Cross of the Order, which is the Conclusion of the Ceremony.

Note, That notwithstanding what the Abbot *Giustiniani*, *Schoonbek*, and *F. Bononi* says of the Antiquity of the Origin of this Order, I am of Opinion that it is entirely chimerical; and that it was only to give it the Precedency above all others, that the Emperor *Constantine* was made Author thereof. For there is no other certain Proof of it but the Marble Stone, which is pretended to have been found at *Rome*, and which represents the Emperor sitting on his Throne, and giving the Collar of the Order to a great Number of Knights: But if that Stone be a mere Fiction, as *Papebroch* says it is; if the Figures represented upon it are nothing else but the Work of a modern Sculptor; lastly, if the Inscription read on it has nothing of the antient *Roman* Inscriptions, one must confess, that the Authors we have followed them are mistaken, and that the Abbot *Giustiniani* they have took for their Guide, was glad to honour with a very antient Origin, an Order, of which he qualifies himself a Knight, and great Cross.—Not but that there might have been, perhaps, a military Order established ever since the ninth Century. We learn from the History of the Earls of *Poitou*, that *William the Pious*, Duke of *Aquitaine*, and Earl of *Auvergne*, who succeeded *Guerin* his Brother in the Year 887, had founded 25 Knights in the Church of *St. Julian of Brioud* in *Auvergne*, to wage War against the *Normans*, which Knights were changed afterwards into Canons. But the Title of that Foundation is so dubious, and it even appears so formally contested by contrary Acts, that one cannot depend much on what the History of the Earls of *Poitou* says of the Foundation of those Knights.

But let's return to the Proofs alledged in Favour of the Antiquity of the *Golden Angel*, instituted by *Constantine*. The principal is extracted from the Letters of Pope *Leo*, of the Year 456, addressed, as pretended, to the Emperor *Marcian*, whereby he confirms that Order under the Rule of *St. Basil*; and from some other Letters of the Emperor *Leo I.* of the Year 489, found in the Archives of the Court of *Rome*: But we learn from Count *Majolino Bisacciani*, Chancellor of the same Order, that those Letters are supposit: That they were not deposited in those Archives before the Year 1533, together with some other pretended Titles of that Order, printed at *Placentia* in the Year 1575, by the Care of Doctor

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Francisco Maleuzzo. This Testimony appears the less suspected, as it is extracted from a Discourse of the same Chancellor found at the Beginning of the Statutes of that Order, printed at *Trente* in 1624; and likewise at *Rome* the same Year, by order of the Grand Master, *Martin Caracciolo* Prince of *Avellino*, who had held the same Year a Chapter of the Order at *Avellino* in the Kingdom of *Naples*, where those Statutes had been digested, and which were no others but those which had been ordered by the Emperor *Isaac Ange Comnene*, in the Year 1190; and which were then renewed. Whence it follows, that that Emperor, called by *Giustiniani* the Reformer of the Order, could very well have been the Institutor thereof, and given the Name of *Constantine* to it, because the *Comnenes* pretended to be descended from him. He might likewise have called it *Angelic*, because of the Name of that Emperor, which was *Angel*; and lastly, *St. George*, because he had put that Order under the Protection of that Martyr.

But however, if this be the most reasonable Antiquity which can be given to this Order, we cannot believe that the Grand Mastership thereof was hereditary in the House of *Comnenes*; which after it had possessed a long Time the Empire of the East, was found at last almost entirely buried under its Ruins. — In fact, after the Infidels had render'd themselves Masters of that Empire, the *Comnenes* found themselves reduced to seek their Subsistence at the Courts of the Christian Princes: Part of them went to *Venice*, and the other Part to *Rome*. — The Count *Andrew Comnene*, to whom the Pope had assigned a Pension of a hundred golden Crowns a Month, about the Middle of the sixteenth Century, being ill paid, and having nothing besides wherewith to subsist, received Money from all Hands to make Knights. He gave, in particular, the Cross of the Order of *Constantine* to two Impostors, who pretended to be of the House of *Comnene*, and who, in Virtue of the Privileges which Count *Andrew* had granted them under that Supposition, pretended afterwards to have a Right to create Knights likewise. But the Grand Master *Peter Comnene*, Prince of *Cilicia*, the Count's Nephew, having opposed himself to it, that Contestation occasioned a Suit of Law, the Judgment whereof proved fatal to the two Impostors; for one of them was condemned to the Gallies, and the other banished by a Sentence of the apostolical Chamber.

Afterwards *Peter Comnene* being employed in the Armies of some Princes, committed the Government of the Order, of which he was Grand Master, to Don *Vincent Leofante Caracciolo*, Grand Prior of *Constantinople*, who caused the Statutes of the Order to be printed in the Year 1583, which had already been printed at *Ravenna* in 1581. He passed afterwards into *Spain*, where they disputed with him the Quality of Grand Prior of that Order, and even seized all his Titles and Privileges; but they were restored to him, by the King's Order, in 1588.

Afterwards the Grand Master *John Andrew Flavius Comnene* himself, Prince of *Macedonia*, was also put to some Trouble, on his Quality of Grand Master. He was cited to *Rome*, where he obtained a Sentence in his Favour. At last, in 1623, this Grand Master resigned the Grand Mastership to *Martin Caracciolo* Prince of *Avellino*, Grand Chancellor of the Kingdom of *Naples*, Knight of the Golden Fleece, and of the Order of *Constantine*; which Resignation was confirmed in the Month of *May* 1624, by *Andrew*, *Peter*, and *John Comnene*, Children of *John Andrew Flavius*.

The Origin of the Order of *S. Sepulchre*, is not better ascertained than that of the Order of *Constantine*; for some Authors say, that *St. James* first Bishop of *Jerusalem* having established some Guards for the *St. Sepulchre*, formed them into a Kind of Militia under the Standard of the Cross, in the Year of Christ 96. — Others attribute that Order to *St. Helena*, *Constantine the Great's* Mother, after the miraculous Invention of the holy Cross; because that pious Princess built a Church in the Place where the Cross was found; and established Canons in it: As well as Soldiers to defend the Place,

in Case of any Insult, and to render the Roads secure for the Pilgrims who should come to visit it. — Lastly, others pretend that after the Holy Land was reduced under the Yoke of the Infidels, and the Christians were allowed the Exercise of their Religion but with much Difficulty, the Lustre and Splendor of that Order began to suffer an Eclipse, and was almost lost, till *Charlemagne*, whose Empire lasted from the Year 801, to the Year 815, had re-established the Dignity thereof; that that Emperor made a Treaty with the King of the *Saracens*, whereby those Knights, and all the Christians in his Dominions, had the free Exercise of their Religion. *Memnius* believes that *Charlemagne* was the Restorer of the Order, which was almost extinct: That he prescribed the Laws thereof, and gave the Knights the Rule of *St. Basil*; that ever since that Time those Laws have been approved and augmented by the greatest Princes, which Laws are as follow; and are preserved to this Day at *Jerusalem*.

Article I. — In the Name, and in the Honour of God the Father, Son, and Holy Ghost; and of the blessed Virgin *Mary* his Mother; of the Angels and Archangels, of the Patriarchs and the Prophets of God, of the Apostles, Evangelists, holy Disciples, &c.

Article II. — May it be known and evident to all the most excellent and illustrious Princes, Nobles, Knights, and to all the Christian People that in the Year of Grace 1099, the most illustrious, invincible, and serene Princes, *St. Charlemagne*, Emperor and King of all *France*, *Louis VI.* of the Name, called the *Wise* and the *Pious*; *Philip* called the *Wise*, the *Magnanimous*, and *Conqueror*, the most holy and magnanimous *Louis*; the President *Godefroy de Bouillon*, and the other magnanimous Christian Princes and Kings; after they had secured their Crown and States, have vowed and freely promised to God, to expose their Life, their own Person, and their Estates; and carry War beyond the Seas, to fight, conquer, and destroy the perverse and tyrannical Nation of the *Saracens*, their Power and Authority; and to conquer the Kingdom of *Jerusalem* in particular, his Territories, Demesnes, &c.

Article III. — Let it be known, likewise, that we, just mentioned, have fulfilled our Obligation with Regard to the Vows above expressed; and by God's Grace, we have acquired, through our Cares and Diligence, the Kingdom of *Jerusalem*, and the Territories possessed by the *Saracens*; have gain'd several Victories over them; and extended the Christian Faith; wherefore the Name of most Christian Prince has been given to us, by the other Princes, and all the Christian People, &c.

Article IV. — Moreover we have received with Humility from the great City of *Rome*, the most holy Crosses, in the Honour of the Passion of our Lord *Jesus Christ*, &c. that thereby we may be more strengthen'd against the Infidels, &c. Therefore all Things duly considered, we have resolved to establish the Order of *St. Sepulchre*, in our City of *Jerusalem*, in Honour, and to the Glory of the *Holy Resurrection*; and have united to our Name of first Christian the first Dignity of that Order; and will that five red Crosses shall be wore in Honour of the five Wounds of *Jesus Christ*; and have created several Knights of that Order, to whom we have given for Mark and Ornament of their Dignity, the five Crosses above-mentioned, to animate and encourage them against the Infidels, who, for that Reason, have been put to flight, and could not resist our victorious Arms.

Article V. — And that those Knights, and all other military Men, who shall pass into the *Holy Land*, and contribute to the aggrandizing the Christian Faith, &c. may be encouraged more and more to do it with greater Facility, we have permitted them, and we permit them to use and enjoy the same Powers, Pre-eminences, Privileges, and Rights, our Officers, and Domesticks enjoy and use, &c. All the other Articles run in the same Style, and contain the Rules or Laws to be observed by the Knights.

Note. That the simple Reading of those Statutes, suffices to shew, that the Antiquity of the Order of the Knights of the *St. Sepulchre* is chimerical; not as the Abbot *Justiniani* observes, because the Date, which is of the 1st of *January*, 1099, is not agreeable to the Time,

Time of the taking of *Jerusalem*; for though it was the 17th of *July* of the same Year, that the *Christians* rendered themselves Masters of that City, that's not an Obstacle to the Statutes having been made the 1st of *January*; since *Godefroy de Bouillon*, who was a *Frenchman*, followed the Stile of *France*; where they began the Year at *Easter*; and therefore the City of *Jerusalem* having been taken the 17th of *July* 1099, those Statutes, though dated the 1st of *January* of the same Year, were, notwithstanding, posterior, by very near six Months, to the taking of *Jerusalem*.

But the best Reason which discovers the chimerical Antiquity of those Statutes, is, that they do not answer the Time those Princes lived in, to whom they are attributed. We see, for Example, in the second Article, that mention is made of the Kings of *France*, *Louis VI.* *Philip II.* and of *St. Louis*, who did not begin to reign, *Louis VI.* but in the Year 1108, *Philip II.* in 1180, and *St. Louis* in 1226. We see, likewise, in the same Article, *Charlemagne* among the Princes who vowed to expose their Persons and Fortunes, and to cross the Seas, for the Deliverance of the *Holy Land* from the Tyranny of the *Saracens*; and in the following Article, they are made to speak all together, as having accomplished their Vows, after they had render'd themselves Masters of the Kingdom of *Jerusalem*, and expelled the *Saracens* from what they possessed in the *Holy Land*, which had gained them the Name of *Most Christian*; though it is very certain, that *Charlemagne* never went to the *Holy Land*. We only learn from History, that *Aarat* King of *Persia*, who despised all the Princes of the Earth, valued the Friendship of *Charlemagne*, sent him several Presents, and that knowing the Devotion of that Prince for the *Holy Land*, and for the City of *Jerusalem*, he gave it him, reserving only to himself the Title of his Lieutenant in that Country. If, notwithstanding, that Present was any Thing else but a Compliment void of Reality. We see, afterwards, in the fourth Article, that all those Princes, though they lived in Times so distant from one another, unite, notwithstanding, to establish the *Military Order* of the *St. Sepulchre*.

Therefore it is only to infer hence, that we are not to depend on those supposed Statutes, to attribute to *Godefroy de Bouillon* the Institution of the *Order* of the *St. Sepulchre*, or the Restoration thereof; since it is not to that Prince it is attributed by the best Authors, but to *Baudouin I.* his Successor, in the Year 1103. In effect, we read in *Belloy* and *Favin*, that the *Saracens* having conquer'd the City of *Jerusalem* of the Emperors of the East, they left the Guard of the *St. Sepulchre* to regular Canons: That *Godefroy de Bouillon* having render'd himself Master of that City, gave large Possessions to those Canons; and that *Baudouin* made them Knights of the *St. Sepulchre*. *Favin* adds, that that Prince order'd they should retain their white Habit, on which they should wear a Gold Cross, potent, and canton'd of Crosslets without Enamel, such as the Kings of *Jerusalem* used to wear in their Arms. And *Du Brueil* in his Antiquities of *Paris* relates the Beginning of the Letters of that Prince for the Institution of those Knights. They are in *French*, which shews the Falsity thereof, for the Language is modern, and has not the least Mark of Antiquity. But if they were in *Latin*, and of a Stile used in the 12th Century, they could not be less apocryphal, as well as the Statutes of the Year 1099, above-mentioned; for it is certain, that there has been in the Church of the *St. Sepulchre*, none but secular Canons, till the Year 1114, that the Patriarch *Arnoul* obliged them to make Vows, and to embrace the Rule of *St. Augustin*. And there is a great Appearance, that the Knights of the *St. Sepulchre*, established themselves but 400 Years afterwards, on the Ruins of the Canons who had the same Appellation, and whose Lands were united and incorporated to the *Order* of *St. John* of *Jerusalem*.

In fact, those Canons having been obliged to abandon the Houses they had in the *Holy Land*, when the *Christians* were expelled from it by the *Saracens*, retired in those they had in several Provinces of *Europe*, where, in most of them, they exercised Hospitality

towards the Pilgrims who went to visit the holy Places in *Palestina*. Pope *Pius II.* having instituted in the Year 1459, a *Military Order*, under the Name of *N. D. of Bethleem*, suppressed some other *Military Orders* and Hospitallers, among whom were the Canons of the *St. Sepulchre*, whose Possessions he united to that new *Order* of *N. D. of Bethleem*. But then those Canons of the *St. Sepulchre* opposed that Union, and no more Mention was made of their Suppression, the *Order* of *Our Lady* at *Bethleem* having not subsisted. But in the Year 1484, Pope *Innocent VIII.* united them anew, and incorporated them to the *Order* of the Knights of *St. John* of *Jerusalem*, or of *Rhodes*, as it was called then, because they were still in Possession of that Island; and by the same Bull the Pope unites to that *Order* that of the Knights of *St. Lazare*.

It must be observed, that in that Bull, the Pope does not speak of the *Order* of the *St. Sepulchre*, as of an *Order* of Knighthood: A Title, notwithstanding, which he gives to that of *St. Lazare*. If the Canons of the *St. Sepulchre* had been Knights; we are to presume, that he had given the Title of Militia to their *Order*, as he gave it to that of *St. Lazare*. Therefore there is great Appearance that he did not mention yet the Knights of the *St. Sepulchre*, who were established on the Ruins of the Canons, who, in fact, were suppressed in *Italy*, *France*, and *Flanders*; and their Possessions truly united to the *Order* of the Knights of *St. John* of *Jerusalem*, except in *Poland*, where those Canons have always subsisted. There were, likewise, two or three of their Houses in *Sicily*, who did not enter into that Union, and are, at present, but Priors, in commendam, at the Nomination of the Kings of *Sicily*.

Pius IV. having confirmed that Union by a Bull in the Year 1560, does not speak, neither, of the *Order* of the *St. Sepulchre*, as of a *Military Order*; therefore it is without the least Appearance of Reason, that some Writers say, that Pope *Innocent* suppressed the Knights of the *St. Sepulchre*, and united their *Order* to that of the Knights of *Rhodes*. It is much more likely that the Knights of the *St. Sepulchre*, came after the Canons of that Name, and that Pope *Alexander VI.* to excite noble and rich Persons to visit the holy Places in *Palestina*, and to reward them, in some Measure, for the Pains and Fatigues they had undergone in so long and tedious a Journey, wanted that some of them should be honoured with the Quality of Knights of the *St. Sepulchre*, in instituting a *Military Order* of that Name, declaring himself Grand Master thereof, and attributing to the Holy See the Power of making those Sorts of Knights, according to all the Authors who have mention'd it; but who do not relate the Bull of that Pope, assuring only, that that Bull is of the Year 1496, and that as the Religious of the *Order* of *St. Francis* have the Guard of the *St. Sepulchre*, and their Guardian is apostolical Commissary, in those Parts, that Pope gave him Power, likewise, to make those Sorts of Knights; though this is not taken Notice of by the principal Historians of that *Order*. Father *Quaresmo*, who was Guardian of that Convent of the *St. Sepulchre*, speaks of it on the Testimony of *Favin*. He confesses only, that he has found at the End of the Book of the Privileges granted to the Guardian of the Religious of *St. Francis* in the *Holy Land*, a Permission which *Leo X.* gave him *viva voce*, in 1516, to make Knights of the *St. Sepulchre*, as his Predecessors had done; which *Clement VII.* granted, likewise, *viva voce*, in the Year 1525; and *Pius IV.* confirmed by a Bull of the Year 1561, all the Privileges which had been granted to those Religious, and to the Guardian of the *Holy Land* by the sovereign Pontiffs, as well *viva voce*, as in Writing.

Therefore it is certain, that the Guardian of the Religious of *St. Francis* in the *Holy Land*, is in Possession of making Knights of the *St. Sepulchre*, and though those Knights should be noble, most of them, notwithstanding, are but Commoners and Merchants. They enter that *Order* by a false Oath, since they are asked, first, if they be of a noble Extraction, and if they have a Fortune sufficient to live without trading, which is believed on their Word, tho' they never deny it.

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The ORDER OF THE CROISADE, is also a chimerical Order of Knighthood, which has no other Foundation but in what follows.

The great Losses which Christendom suffer'd from that the *Turks* possessed all the Fortresses and Places where our Lord and his Apostles had conversed, engaged in the Year 1095, the Christian Princes, solicited by the Zeal of the Popes, and by their Compassion for those holy Places, to go and free them from the insupportable Yoke of those Tyrants. Pope *Urban II.* was the first, who, by his Legates, at the general Council of *Placentia*, exhorted the Christian Princes to undertake that Expedition.

At the Solicitation of the Emperor of the East, and at the Persuasion of *Peter l'Hermite*, another Council was assembled at *Clermont* in *Auvergne*, where the Pope himself, by his pathetical Discourses, made such an Impression on the Heart of those Princes, that they promised to arm for the Deliverance of *Jerusalem*, and of the *Holy Sepulchre*.—The Chiefs of that Expedition were *Godefroy de Bouillon*, Prince of *Lorrain*, *Eustachius* and *Baudouin*, his Brothers, *Baudouin del Borgo*, the Earl *Reiner*, *Hugues the Great*, Brother of *Philip* King of *France*, *Robert* Earl of *Normandy*, *Raimond* Earl of *Thoulouse*, *Boemond* Earl of *Pouille*, *Tancrede*, and several other great Lords of the most illustrious Houses of *Europe*.

The Pope having promised in full Council a great Quantity of Indulgences to them, and to all those who would go to that War, gave them for Badge a Cross, which every one was allowed to wear of the Colour he pleased, according to the Diversity of the Inclinations, and Humour of each Nation, and without establishing any fixed Rule, the Cross was fastened either on the Breast, or on the right Shoulder, or on the Cap, or Helmet, or the Shield, according to the Constitution of the Council of *Clermont*, conceived in these Terms; *That all those who would undertake the Journey to Jerusalem should wear the Sign of the Cross on their Cap, or on their Habits.*

In 1096, they departed with all their Forces, which some make to amount to 30,000, others to 40,000, others to 60,000 fighting Men, and took the Road of *Syria*, where they began their Expedition by the Defeat of 50,000 *Turks*, which was followed by the taking of *Nice*, *Mesopotamia*, and of *Media*. The Year following they gained another signal Victory, where 100,000 *Saracens* perished, and the Fruit thereof was the Reddition of *Antioch*, which surrender'd to the Christians. In 1099, *Jerusalem*, which had groan'd during 490 Years under the Tyranny of the *Turks*, was also taken, and *Godefroy de Bouillon* proclaimed King thereof, and crown'd with a Crown of Thorns.

As that War had already lasted four Years, and the Christian Army, which was then much weaken'd, wanted Recruits; Pope *Paschal II.* provided to it, by engaging the Emperor *Henry IV.* to equip a very large Fleet, which set sail in 1101; at whose Arrival the Enemies raised the Siege of *Jaffa*. Mean while the *Genoese* harrassed them much at Sea, and even took *Casarea*, and some other Places on the Coast.

Though the Union wherewith that Expedition begun was very great, the Division which Ambition, or Avarice, occasioned among the Chiefs of the Army, produced Effects very hurtful to the common Cause. Which Misfortune did not hinder, notwithstanding, King *Baudouin* from obtaining, in the Year 1105, a very great Victory over the *Turks*, in a naval Fight; which gave him Occasion to join to his Kingdom, the Cities of *Tiberiades* in *Galilee*, *Sidon*, and *Accaron*, the Fortrefs of *Sobal*, and other Places besides on the Coasts of the *Mediterranean*.

As the Change of Sovereigns causes also but too often Changes in the Affairs of State, *Foulques* of *Abjou*, having ascended the Throne after *Baudouin's* Death; and after that of *Foulques*, his Son *Baudouin III.* a young Prince, who had much Wit, having been called to the Crown, his Forces were not found strong enough to bear the Weight thereof. Notwithstanding which, the Terror of his Name, and the Reputation of his Arms, had yet Power enough to maintain, while he lived, the Affairs of the Christians; but after his Death, the *Turks* taking Courage, went to ravage *Mesopotamia*, and the Country of *Antioch*.

The Christians finding themselves much weakened, assembled together, and concluded to send for Succours out of *Europe*. Pope *Eugenius* was not less embarrassed by the Differences which had happened among the *European* Princes, than the Christians were in the Holy Land. But the Disorders being appeased, at last he sent his Legates to *Louis VII.* King of *France*, and to the Emperor *Conrad*, to exhort them to raise in *France* and *Germany* as many Forces as they could. He assembled in the Year 1146, a general Council at *Chartres* in *France*, where it was resolved to make a third *Croisade*, the Conduct thereof should be given to *St. Bernard*; who excused himself on his Insufficiency, taking only upon him to go in the neighbouring Countries to excite the People, and engage them by his Reasons and Prayers to undertake that Expedition. At last, by his Means another Council was assembled at *Veselai* in *Burgundy*, at which assisted the Pope, King *Louis*, *Eleonora* his Queen, and a great Number of other Princes, who engaged in this new *Croisade*. The Emperor *Conrad* did the same Thing in the Year 1148; therefore a formidable Fleet was equipped, but not under fortunate Auspices.

This Fleet arrived on the Coast of *Syria*, where the Forces were landed. Having joined those of the Emperor *Conrad*, it was found that the Division which reigned among the Princes had put the Affairs in a very bad Condition, and that the Number of Christians was extremely diminished by Famine, Misery, and the Plague, which were considered as the fatal Consequences of that Division. The perfidious *Greeks* who sometimes took the Part of the *Latins*, and sometimes that of the *Germans*, and even often that of the *Turks*, attacked *Roger* King of *Sicily*, and thereby obliged the Emperor and the King of *France* to return into *Europe*. That Retreat left the Countries conquered in *Syria*, a Prey to *Noradin* and *Saracens*, Generals of the *Turks*, and of the *Saracens*, to *Damascus*, and to the Soldan of *Egypt*. The Loss of *Mesopotamia* and *Aleppo*, having been the Effect of the Dissentions which were among the Christians, *Emilius* Patriarch of *Jerusalem*, and the two Grand Masters of the Knights Templars, and of the Hospitallers of *St. John*, sent Envoys into *Europe*, to inform the Princes of these Parts of the Danger they were in. Those sinistrous Events touched sensibly the Heart of Pope *Alexander III.* and engaged him to procure a new *Croisade* in the Year 1180, but he died while it was yet but in Agitation. *Lucius III.* his Successor, followed his Steps in that Affair, and spared nothing to make that Project succeed. He wrote to the Kings of *France* and *England*, and his Exhortations had so much Power, that an Assembly was held at *London*, where it was resolved to undertake a new Expedition for the Holy Land. But this Resolution remained without Effect, because of the Differences which happened between the two Crowns of *France* and *England*, and which could not be appeased by the Mediation of *Urban III.* though he applied himself with much Zeal to reunite the Minds of the Christian Princes.

During those Dissentions, and the others which reigned between *Guy* King of *Jerusalem*, and *Raimond* Earl of *Tripoli*, *Saladin*, at the Solicitation of the Knights Templars, who pretended to have some Reasons of Discontent, retook *Jerusalem* in the Month of *October* of the Year 1187. In that Expedition more than 220,000 Men perished, as well Inhabitants as Soldiers, among whom were several Templars; and the King himself was taken. The Loss of the holy City carried along with it, that of *Laodicea*, *Ptolemaide*, *Barut*, *Tiberiade*, *Ascalon*, and several other Places, whence the rest of the Christians were obliged to retreat to *Tyre*, to *Antioch*, and to *Alexandria*. This was a mortal Blow for the Pope, who in fact died of Sorrow for it soon afterwards.

Clement III. having succeeded him, exhorted with all the Zeal possible, the Christians to undertake again a new Expedition; the Publication thereof being made in the Year 1188, there was seen a general Impulse to march. *William* Archbishop of *Tyre*, gave, himself, the Cross to the Kings of *France* and *England*, and to a great Number of Lords of the first Rank. The Emperor *Frederick Barbarossa* caused to be declared to the Sultan *Saladin*, that if by the first of *November*, he did not restore to the Christians *Jerusalem*, and all the other holy Places, he would go himself in Person, and ra-